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CHINA REPORT

SCIENCE AND TECHNOLOGY

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NATIONAL DEVELOPMENTS

IMPORTANCE OF ALLOCATION TO S&T RESTRUCTURING

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [STUDY OF SCIENCE AND MANAGEMENT OF S&T] in Chinese No 5, May 86 p 1

[Text] One of the biggest problems with the science and technology system that has existed in this country for so long is that science research is divorced from production. There are certainly many reasons for this, but chief among them is that there is no commercialism in the administration and technology of the allocation system.

According to statistics, there are currently 9,900 research organizations in this country, involving 1.2 million people, among which organizations are 4,700 civilian independent research and development organizations, with a staff of 770,000, that depend upon government financing for their support (military and factory-run institutes have not been included). These research organizations that have eaten from the "government public allocation" have for a long time depended upon tasking from upper levels. After achieving results, they then report the findings to those upper levels. There are many problems in this kind of allocation system: 1) It is very difficult for state tasking to be in complete accordance with the needs of production, and work at research institutes is not directly restricted or tested by economic and social requirements, which naturally leads to a separation of science of science and technology from production. The limited national outlay cannot satisfy the needs of all research organizations, so projects that should take 1 or 2 years to complete are going on for 3 and 5 years, or even longer, because of inadequate financing. This has kept many talented scientists and technicians from being able to make better contributions to economic development. Consequently, the many problems of technology for the hundreds of thousands of small and medium enterprises still await resolution. 2) Because each research institute has its own independent funds, they can arrange for their own projects, so it is difficult to prevent the repetition of low quality research projects. This has made the results of all science and technology differ widely. 3) The former allocation methods were not in accordance with the characteristics of varying scientific and technical activities, and there was categorical management of research units, which could not encourage the scientists and technicians involved in various kinds of scientific and technical activities to make their best efforts according to the characteristics of their own particular work, as they could not obtain

reasonable funding and support. Naturally, this has obstructed the improvement of research standards and work efficiency.

In changing the old system, what kind of principles should be followed when setting up the new system? Comrade Zhao Ziyang clearly pointed out at the national science and technology working conference that there will be many differences between the new science and technology system and the old system, but that the most important thing is that it be suitable for our socialist planned commodity economy. Experience over the last 30 years has shown that as we have preserved the commodity economy, we have had no regard for the relations between commodity and money, and we have had no regard for the laws of value nor for economic levers. Therefore, we have not been able to accomplish things having to do with the economy, things that we have wanted to accomplish have often gone astray, there has been effort without result, and most often, much more work for half the reward. Thinking back over the years since the establishment of this nation, for a long time we proposed making grain the key in order to solve the food problem. We wanted the Party secretary to take command, but this problem was not solved. It has only been since the Third Penum that the Central Committee has focussed on economic rules, and after understanding production relations in the countryside, a few years of effort has now basically solved the rural problems.

We have also expended much effort on this problem of the separation between science and technology and production, but have not yet used economic methods, relying instead upon administrative methods, and the results have not yet been what we have desired. The resolution issued by the Central Committee in 1985 regarding restructuring of the science and technology commission focused on the two chief links: restructuring of the allocation system, and implementing commercialization of technical commodities. These two keys are on the one hand the basis for our current restructuring of the science and technology system, and on the other hand are the important economic means by which to implement the restructuring.

Restructuring the allocation system is more important than commercializing technology. Only by changing the allocation methods, and by getting rid of the "great ricebowl," can "commercialization" succeed, and opening up technology markets is also one of the prerequisites for restructuring the allocation system. We may figuratively call this "blocking off the old road while leaving one side of the net open," that is, for those development type research institutes, we will gradually reduce allocation, suffocating one aspect and encouraging them to become economically independent, and at the same time we will let the other aspect live, opening wide all channels for the circulation of technology and allowing science and technology research organizations to be able benefit from serving the economy and the society. Of course, for those units engaged in basic research and applications research, restructuring of their allocation system will primarily focus on getting operating expenses from basic funds.

Only by changing the allocation methods and commercializing technology can we compel the majority of research units to broaden applications from selection of projects to results, to connect them with economic and social requirements, and to allow science and technology to generate internal motivation for

catering to the economy. Research units will obtain direct economic results from the economic sector, or will receive operating expenses and support from society, they will seek to survive in competition, will strive for advances, and will improve their efficiency and their own ability for science research.

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NATIONAL DEVELOPMENTS

PARTICULARS OF REFORM OF S&T ALLOCATION SYSTEM DISCUSSED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENCE OF SCIENCE AND MANAGEMENT OF S&T] in Chinese No 5, May 86 pp 2-5

[Article by Guo Shuyan [6753 2885 6056], State Science and Technology Commission: "The Basic Principles and Particular Methods for Reforming the Science and Technology Allocation System"]

[Text] I.

There are five basic principles for restructuring science research operating expense management: 1) use different management methods according to the characteristics of different scientific and technical activities; 2) broaden the sources of funds and implement multi-sourcing for science and technology funds; 3) funding and tasking go together, so implement partial compensation for use; 4) break up barriers, promote competition, support the best; 5)strengthen management by authority for science research operating expenses, and allow scientific and technical management departments to be responsible for proper management and use of these funds.

To implement categorical management in accordance with the characteristics of different types of scientific and technical activities is a primary feature of the new science research operating expenses management methods. The particular methods for categorical management are:

1. Have a technology contract system for technology development work and for applications research from which near-term use can be expected.

Technology development is research that directly caters to production and to the first lines of the economy. These research activities are bound by common cause with the progress and aspirations of enterprises, with the development of new products, and with the transformation of industrial technology. The features of this kind of research are great practicality, high directionality, and that research accomplishments can be transformed into production quite quickly. More than 3 years of experience from experiments has shown that when these research units implement technology contracts, they are certain to overcome the shortcomings of the old allocation system, providing the unit with vigor and energy. First of all, it leads scientists and technicians to obtain funds through either vertical or lateral contracts based on objective

requirements, to put their efforts into studying and solving various technical problems that arise in economic construction, and to promote the close integration of science and technology with the economy; second, it encourages scientists and technicians to leave the unit, cater to the economy, cater to society, cater to the marketplace, and to broadly disseminate knowledge and science and technology, allowing the entire society to benefit; third, it forces research units to diligently improve the quality of their own personnel, work efficiency, and technical standards, to survive in competition, and to plan for development. It urges them to produce more results, to produce better results, as well as to transform the results into production forces as quickly as possible; fourth, it has increased the economic benefits to research units, strengthening their vitality for self-development; fifth, in implementing a technology contract system, "whoever is responsible earns the money," and this has begun to break up barriers and has promoted the socialization of science and technology work; sixth, it has given the state the possibility to more effectively make use of science research operating expenses.

According to the provisions of the documents of the State Council, the state has allocated science research operating expenses for this kind of research organization. During the "Seventh 5-Year Plan," this was gradually reduced until it has been completely stopped. Of the reduced operating expenses, two-thirds will be retained by the departments for use in professional technology work, to aid major research projects of the state or profession, and one-third will be concentrated in the State Science and Technology Commission to be used to authorize credit for science and technology that is of a national nature, and as discounted funds for science and technology loans, and a portion will also be used as development funds for replenishing technology in professions of a national nature or to open laboratories up to the outside.

Because reform of the economic system in this country has had a late start, the motive forces and vitality from technical advancement upon which enterprises depend cannot be developed all at once. In addition, some policies to accompany the restructuring of the science and technology system have yet to be established or perfected. Therefore, the reduced and halted allocations of science research operating expenses and the self-sufficiency of research units must also undergo a transition process, and must proceed in accordance with actual conditions. The reduced allocation of operating expenses will be in step with increases in income and the opening of technology markets, and will not be subjectively arranged with excessive haste.

2. Implement a funding responsibility system for units engaged in research or in socially beneficial basic technology work, as well as for units in agricultural science research.

The contributions of this sort of unit to society are hard to evaluate by direct economic results, and it is hard to make the economic income directly received by this unit from society depend upon those results. Therefore, in order to meet the needs of society, the state will allocate funds when the tasking of these units is truly socially necessary, contracting for their use. Personnel affiliation in the contracting unit, and their wages and rewards,

will be strictly controlled. For some units that have trouble completing their contract tasking, the responsible department will take charge and rectify the situation or adjust the direction of their tasking.

To enhance the vitality of these units, in addition to a certain yearly growth in funding from the economic viewpoint, the state encourages them to seek a reasonable income apart from completing the tasking as assigned by the state. Distribution of the income has been clearly prescribed in Document No 12.

3. Implement a science funding system for basic research and for applications research from which no near-term application value can be expected.

Facts in the development of current science have shown that important breakthroughs in basic research always open new roads for technology development, and the process by which the results of basic research are transformed into technology is being steadily reduced. Applications research is the necessary link by which the results of basic research are transformed into applied technology. It has great significance for opening up new technologies, for developing new products, and for upgrading existing production technologies. Therefore, at the same time that this country is emphasizing work in technology development, we also stress the stable continued development of applications research and basic research. The state highly respects basic research. During the Sixth 5-Year Plan, the funding allocated by the state to basic research grew greatly over that of the past, and during the Seventh 5-Year Plan it will continue to grow. Basic research ought to cater to the world, to the future, and to the challenge of the forefront of science, to seek glory for the motherland, and to enrich mankind. But there should not be too many people involved in basic research, for more people would have no effect. Therefore, the key to avoiding redundance in projects lies in discovering talent and in increasing the degree of funding for key projects, providing major support for hopeful projects.

An important means by which to solve problems in this area is to implement a science funding system. Since 1982, this country has engaged in experiments with science funding systems of limited scopes, and has come up with a set of science funding application, approval, allocation, and management methods that suit our national conditions, and which have been universally welcomed by research personnel. Recently, the State Council has set up a National Natural Science Foundation, and with the support of the Ministry of Finance and the State Planning Commission, the total amount of the funds available for this Natural Science Foundation this year has increased greatly. The science funding system from now on will be carried out everywhere. Research expenses for units primarily engaged in this kind of research will gradually come to depend primarily on applying to this fund. To support the work of these research units, the state will continue to allocate operating expenses to a certain degree to guarantee necessary regular expenses and expenses for public facilities.

Even for those units engaged in various kinds of research, the sources for their funding will be resolved through the channels of developmental research and basic research.

4. Gradually implement a bidding system for major national science and technology projects.

At present, this part of funding is largely expended from the three-item costs of science and technology. Implementing a bidding system would be beneficial for introducing a competitive system, for improving efficiency, for advancing management, and for saving on investment. Recently, the three organizations (the State Planning Commission, the State Science and Technology Commission, and the State Economics Commission) drew up a management method regarding key projects for the Seventh 5-Year Plan that will progressively implement a bidding system. Although there are certain difficulties with a bidding system, activity in this direction will intensify. This is especially true for those projects that transcend sectors, professions, and sciences, and where implementation of a bidding system can lead to even better results. A recent attempt at a bidding system produced remarkable results. To solve the problems with receiving and viewing television in remote areas, the state has prepared to set up a group of satellite ground receiving stations throughout the country. Originally, a production department was given this tasking, quoting a price of 300,000 or 400,000 yuan for all the necessary equipment. Bidding was instituted after that, bids being received from three departments. Because of the competitive structure, the quoted prices all of a sudden came down to 50,000 or 60,000 yuan. The state has already decided that all major national science and technology projects that are part of the Seventh 5-Year Plan should gradually be subject to bidding.

In summary, the implementation of categorical management would suit the characteristics of different kinds of scientific and technical activities and the rules of their own development, and would better use economic means and competitive structures to change the operation of scientific and technical work. The goal here is to make science and technology better face up to economic construction, and definitely not to reduce the funding for science and technology.

II.

In reforming the science and technology system, restructuring of the allocation system is a major modification and a very great event in the history of science and technology in this country, and it has drawn great interest both at home and abroad. In February of this year, the United States Embassy called a Chinese periodical to inquire whether the reports about reforming the science and technology allocation system were in fact true. They were also interested in what measures the State Science and Technology Commission would adopt to do this.

The reform will change the forms of activities, organizational structures, and certain concepts to which people have become accustomed; this reform will deeply affect more than 1 million scientific and technical workers, it will affect the directions and future of more than 9,000 science research

organizations, and it will affect every field and every segment of scientific and technical work. We will enthusiastically implement the principles of the Central Committee regarding "consolidation, absorption, supplementation, and perfection," and will resolutely and unswervingly continue to move the reform of the science and technology system into the future. Whatever problems are encountered, the reform will be upheld; at the same time, we will also be careful about the way we do things, our steps will be safe, and we will avoid unnecessary social upheaval.

As for the reform of management of science research operating expenses, we have prepared to proceed along two different lines.

During the first 2 years we will move slowly, stressing that there be progress everywhere, relations will be smoothed, and we will examine our experiences. As relations are smoothed and after we have gained some experience, then in the last 3 years it will be appropriate to hasten the pace of reform.

According to the requirements that have been determined by the Central Committee regarding reform of the science and technology system, a number of departments and local areas have reduced the operating expenses of a number of research organizations in a planned and gradual way, and their experiences have been pleasant and the directions are correct. However, Comrade Deng Xiaoping has said that "the reform self-perfects the socialist system, and involves changes of a revolutionary nature within a certain context," and "the reform is revolutionary, and is certain to be accompanied by deep changes in thinking and methodology." Therefore, this reform cannot be seen too simply, will not proceed rashly, nor will it to be completed in a hurry. We must evaluate our difficulties and problems as fully as possible. For this huge ship that is China, slow to change directions, the reform must be over a rather long period. If it is done too quickly, if operating expenses are reduced too quickly and too harshly, this could have an unfortunate effect on the earnings of science research units and on the major national and local science research projects. Some will even go astray. This is especially true for those large, established research institutes of the central departments and of the Chinese Academy of Sciences, and the major provincial and municipal academies and institutes should be even more wary. At present, among the more than 4,700 independent civilian research organizations at the prefectural city or higher level, few could yet be completely independent by depending upon contracts for income. It would be even more difficult for some of the large established institutes. When a research department has not yet fundamentally changed in regard to the direction of the economy, then when operating expenses are reduced too harshly, a small number of research organizations could go astray. The Central Committee has determined that the process basically will be over in 5 years, which shows that the Central Committee hopes that this change will have been completed within the Seventh 5-Year Plan. It appears that the time should not be too limiting, and the methods can also be loosened up somewhat. There is certainly going to be a reduction for the established and larger institutions, but the amount reduced during 1 or 2 years can be somewhat less. Then, after conditions have ripened, there will be more reductions as appropriate. The large and established institutions will make great contributions toward economic construction, and

will progressively enhance their vitality and their ability to develop themselves.

People have been concerned both within this country and abroad that whether science research expenses are to be reduced in this country from now on is actually a misunderstanding. Documents from the State Council have clearly stipulated that the growth of science and technology funding will be higher than the rate of growth for the normal income from national revenues, beginning in the Seventh 5-Year Plan, and that state participation in operating investments for science and technology will increase annually. Based on current arrangements, during the Seventh 5-Year Plan, three-item funding by the state for major science research projects will grow by nearly 50 percent compared to the Sixth 5-Year Plan. Regarding science research operating expenses, although some units will be gradually reduced, the overall allocation from national finances for operating expenses will still increase annually. It will also be like this for provinces, cities, and prefectures. The development of the commercialization of scientific and technical achievements will open new financial sources for science research units, as with 45 institutes of higher learning in Shanghai in which the income in September of last year [1985] exceeded one-third of total operating expenses. Even if operating expenses are reduced, the total amount will be used for science and technology, and it will be used for science and technology authorized credit funds and as discount funds for science and technology loans. In the areas of basic research and applications research, this year we will begin to formally establish a National Natural Sciences Foundation, and will greatly increase allocations. The banking system will also actively develop its science and technology credit activities, and the amounts used in these areas will also be increased.

In summary, changing allocation methods is assuredly not for the purpose of reducing science and technology funding, but for better using the money uniformly; it is definitely not to reduce national investment, but is to open multi-channel financial resources for science and technology.

The State Council has decided to turn over the science research operating expenses for each department and commission to the unified and authorized management of science and technology commissions. The Science and Technology Commission believes that, first, there should certainly be an earnest appeal to the Ministry of Finance for their opinion, that they will closely rely upon the support of each department, and that they will diligently do this work. Second, the Central Committee and the State Council should let the Science and Technology Commission be responsible for the management of science research operating expenses, and this is in line with the overall picture of the reform. And letting science and technology management departments be able to concentrate the research into more particular sets of policies that are relevant to science and technology reform will promote the restructuring of the science and technology system. Third, management of science research operating expenses must be impartial and unselfish. It must be done so that operating expenses come from science research and are used in science research.

As we now undertake reform of the allocation system, we must pay special attention to the following points:

1. The significance of reforming the science and technology allocation system is very great. Each department must include this work in their agendas of important affairs, they must strengthen their leadership, and they must organize matters meticulously.

2. Reform of the allocation system will begin everywhere this year, so each department must bring its own actual conditions together and formulate particular plans, steps, and methods for implementation, and must also discover problems in actual practice in a timely manner, and quickly summarize typical experiences.

3. Since the reform is a revolutionary change, there cannot help but be various problems. We cannot treat these problems lightly and ignore them, nor should we be panic stricken and simplistically block things up. Instead, we should carry out active leadership on a foundation of objective analysis. When problems occur, as long as we can be aware and not fearful, they can be corrected. But we want to guard against great deviations. These are important ideological and working methods as we guide the reform.

Carrying out a full scale reform of the economic, science and technology, and education systems is historical pioneering work for the Chinese Communist Party and party members, and it is an undertaking that this generation is worthy of accomplishing with diligence. Let us work together with one mind, remaining firm and tenacious and mutually supportive, and cooperating closely to do a good job of this reform of the allocation system, and bring the reform of the science and technology system a little further along.

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NATIONAL DEVELOPMENTS

TANG AOQING DISCUSSES ROLE OF NEW SCIENCE FOUNDATION

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENCE OF SCIENCE AND MANAGEMENT OF S&T] in Chinese No 5, May 86 pp 8-11

[Article by Zhang Ziye [1728 2407 1987] and Wang Shu [3769 2611]: "Three Views of Macroscopic Management of Science and Technology; a Visit with Tang Aoqing, director of the National Science Foundation"]

[Text] A Brief Background on Tang Aoqing [0781 2407 1987]

Tang Aoqing is from Heqiao Township in Yixing County, Jiangsu Province. He was born into the family of a small shopkeeper in November 1915. He was admitted to four well-known institutions in 1936 on account of his grades, finally choosing the Chemistry Department of Beijing University. After graduation, Tang stayed on at the school as an assistant on the faculty.

In 1946 Tang went with the famous chemist Zeng Zhaolun [2582 2507 2241] to the United States for observation and specialized study, where at Columbia University he received his doctorate. In January of 1950, Tang fought off various obstacles from Guomindang agents and resolutely returned to the motherland. In the beginning, he was a professor in the Chemistry Department at Beijing University, and then in 1952, when higher institutions throughout the country were readjusted, he went to Changchun to participate in establishing the chemistry department of the Northeast People's College (former name for Jilin University).

Professor Tang Aoqing has had great successes in the fields of quantum chemistry, polymer physical chemistry, and chemical nitrogen fixation. In 1952, in response to deficiencies in formulas for "intramolecular rotation" as proposed by the famous American quantum chemist, (Pize), he redid the theoretical deductions and proposed the "potential energy function formula," which provided a more dependable scientific basis for the characteristics of matter that changes structure. This accomplishment won a national natural sciences third prize.

In 1963, Tang Aoqing led his research group in developing research into "ligand field theory," which led to the academic monograph "Methods in Ligand Field Theory." This achievement in science research was awarded a national natural sciences first prize in 1982.

In 1981 he was selected as a member of the International Quantum - Molecular Scientific Research Association.

Tang entered the party in 1958, and has often been selected as a representative to the National People's Congress, to the national party congress, and as a member of the Chinese People's Political Consultative Conference. He has been director of the Chinese Chemical Society, a committee member of the State Council Committee on Academic Degrees, a member of the presidium of the Chinese Academy of Sciences, and a member of the board of studies. In 1978 he became president of Jilin University. In February 1986 he was appointed by the State Council to be director of the National Science Foundation.

Professor Tang Aoqing is more than 70, but is still healthy and is always concerned about the development of China's science and technology. Recently, Professor Tang was appointed by the State Council to be director of the National Science Foundation, and we invited him to discuss matters relevant to the National Science Foundation.

Professor Tang says that the National Natural Science Foundation is a management structure for national natural science funding. Its establishment has strengthened the support by the state of basic research and will play a definite promotional role in relaxing the insufficiencies of basic research funding and in uncovering science potential in this country.

He said that the national natural science funding system is one of the important things that have been decided by the Central Committee regarding the reform of the science and technology system, for national natural science funds will be uniformly managed by the Foundation for the entire country. Scientific and technical workers in all areas, departments, and units can submit project proposals in accordance with topic guides and relevant provisions as issued by the National Natural Science Foundation. In this way, not only does science research have a clearer motivational direction, but it can also break through departmental, regional, and unit barriers. Science funds are primarily used to obtain research and management funds for subsidizing projects, among which a certain amount of the funds are used for international cooperation and academic exchange and to support the scientific research of outstanding young research personnel. In this way we can increase the degree of investment in those scientific fields for which there is a national urgent need to develop and in projects at the forefront of world science, which will be advantageous to discovering and cultivating young science talent. In summary, the National Natural Science Foundation will strive to further improve the level of basic research in this country.

We asked of Professor Tang what the mission of the National Science Foundation is. He said that our aim is to effectively use funds for science according to national principles, policies, and regulations for developing science and technology, to guide, regulate, and subsidize basic research and some applications research, to discover and train talent, and to promote the advance of science and technology, as well as economic and social development. We have four specific responsibilities:

1. To formulate and issue project guidelines for basic research and for some applications research according to national science and technology development planning, to accept and review project applications, to organize intra-profession reviews, and to subsidize the best.

2. To accept commissions to provide advice for major problems in aspects of national basic research and applications research.

3. To support other ministries and commissions in science foundation work that caters to the entire country, and to provide coordination and guidance for arranging projects.

4. To establish relations with other national science foundations and relevant scholastic organizations, and to develop international cooperation.

Finally, Professor Tang said that the National Natural Science Foundation is ~~just now at a stage of initiation; the management of science funding is highly~~ scholastic work, and also, at present national funds used for supporting basic research are definitely limited. If we are to use our limited financial resources most rationally and most effectively, then we must enhance science management. If we are to do this work well, on the one hand we must depend upon relevant principles and policies for science and technologies, and on the other hand we must give full play to the functions of scientists and specialists in management. From a certain aspect, the foundation is a scholastic management system with a core of democratic management of scientists and specialists. Professor Tang expressed three opinions regarding the macroscopic management of science and technology. First, regarding strategic deployment, we will make full use of research contingents at the institutes of higher learning; second, in setting up scientific and technical contingents, we will guide scientific and technical workers to strengthen self-cultivation in science morality; third, we will stress the "three news" in research, and view the "three news" dialectically.

Keep Tasking Under Control, Allocate Funds, and Create Conditions to Develop Research Potential in Higher Institutions

Tang Aoqing said that these problems do not need more proof, and that the key is that when the state is making strategic deployments, it must truly respect these contingents in the higher institutions and keep tasking under control for them, allocate funds, and create the necessary conditions.

Comrade Deng Xiaoping has pointed out that higher institutions "are both educational centers and also research centers," and that they reflect the objective rules of the dual tasking that the higher institutions should assume: teaching and science research. Because, if they do not do science research, it will be difficult to improve their academic standards, nor can they foster the capacity of students for independent work. This is especially true for the major universities, which are currently training large numbers of graduate students, who are even more qualified to carry out science research. College undergraduates do their theses only in their last half year or less than that, but for graduate students the situation is not the same. For a 3

year master's program, 1 and one-half years is spent in research; for Ph.D. students there is another 3 years on top of the master's foundation, which is mostly research. Science research is divided into basic research, applied basic research, and development research, and higher institutions should focus on basic and applied basic research, and governments should increase funds for basic and applied basic research at higher institutions to encourage research in these two aspects. Development research should be based upon achievements in basic research and applied basic research, for this is a relay race where first comes basic, then applied basic, and only then applications and development. If we lack basic research and applied basic research, there will be little reserve strength for development research: we must take a long range view.

Many research institutes in the United States have been set up in industrial departments, and some are companies in themselves, handling both production and research. When there are achievements, they are then used. On the other hand, the research institute receives much funding. Much of what they do is basic research, which would appear to have no connection with production. But they regularly take into consideration how much of what they do they will be able to be used in 5 years, how much in 10 years, and how much in 15 years. Their higher institutions undertake only basic and applied basic research. We have many research organizations in this country, and all industrial departments and research institutes primarily should solve problems put forth by production departments, and should establish close relations with industrial departments. In the past, there have been problems with department rights, but there would be difficulties if institutes depended completely on themselves for finding industrial departments with which to affiliate. Funds for each department will be provided to their own research organizations, and they are not likely to give any to outside organizations, and if the outside organization produces achievements, they will definitely not use the outside achievments. Therefore, the allocation of science research funding must be changed.

When discussing improvement in the quality of teachers, Professor Tang said that there are two ways: one is to further improve existing teachers to allow us to make the most of those we have now. The other is to supplement them with new teachers. From where will new teachers come? They will come from master's students and from Ph.D. students. Perhaps there will even be those who come from abroad, but for the most part we must rely on this country. The quality of our current graduate students is not bad. In 1985 we tested the quality of graduate students in five specialties at the masters level: organic chemistry, physical chemistry, chemical engineering, communications, and political economics. The results of the testing were quite good. I believe that the level of our masters' students is admittedly higher than that of foreign masters' graduate students. Of course, the level of doctorate students needs improvement. Look at the United States, for example, where they have been training doctoral students for 100 or 150 years, and the level of their doctoral students is high. I visited the United States in August of 1984. Their theoretical work is characterized by a close connection with new experiments. They do not wait for papers to be published, but obtain the data from experiments by phone, and then immediately undertake theoretical work. As the experimental results come out, so do their theoretical results.

As we discussed the subject of teaching at higher institutions, Professor Tang said that the key lies in the teachers. The prerequisite in selecting and taking classes is that the number of classes that must be taken cannot be too high, for when there are many classes, then we have implemented a credit system in name only. When the curriculum is reduced, the number of class hours is reduced, and students can take classes from the better teachers. Take for example basic classes in chemistry, where there are organic chemistry, inorganic chemistry, physical chemistry, analytical chemistry, and the structure of matter. These can be streamlined and the essential and extraneous can be clearly distinguished. If the most important things are taught to students, students will not feel that it is too much. It is not good if each class is taught too long and in too much detail, and if we change streamlining to concentration, not distinguishing the essential from the secondary, we will then increase the burden of the student until even that that should not be streamlined drops by the wayside. A good teacher is aware not only of transmitting knowledge, but in the process of transmitting that knowledge, is also aware of the ability of the students to read and their abilities to analyze and solve problems.

Higher institutions should emphasize basic classes: the fundamental ideas, the fundamental knowledge, and the fundamental technical abilities in basic classes are all very important to undergraduate majors and to graduate students alike. Basic classes should be taught by the best teachers. After graduate students have graduated, they can also take up the teaching of basic classes.

Be Strict in Study, Sincere in Cooperation, Practical, and Let a Hundred Schools of Thought Contend

Professor Tang said that any given contingent must do research and must also have certain material conditions available. However, whether the material strength of this contingent can be used to its utmost still depends upon the spiritual state of this contingent. The spiritual strength is not visible, and it cannot be enlarged until it can be replaced by material strength, but spiritual strength cannot be ignored. This is because under similar material conditions, even under material conditions that are greatly divergent, spiritual strength can actually be transformed into enormous strength, creating inconceivable wonders.

In recent years, many scientists have established excellent moral habits, and have accelerated the development of the profession of science. Even so, on occasion, fraud, mutual disobedience, and mutual counteraction have appeared among a small number of scientific workers.

Professor Tang said that those who engage in scientific work must not only be diligent in practice and sensitive in thinking, but must also possess excellent scientific morality. How then can we strengthen the cultivation of a scientific morality?

1. The atmosphere for study should be strict, and one's attitude should be diligent; citation of evidence, deduction, calculation, and testing must be

reliable, no doubt must be passed off, and there can be no deception whatsoever.

2. Treat others and oneself correctly, be sincerely cooperative with colleagues. Between advisers and aides, and between colleagues there should be sincere exchange of opinions and mutual respect. When achievements have been made, do not exaggerate one's own contribution, and even less should one seek recognition or advantage, and demean others. And especially, do not regard the function of the research group lightly, and even less do not turn around the research achievements of the group to be the first to publish something. These ways of seeking fame are quite immoral.

3. Evaluate science research achievements by seeking the truth from facts. After an achievement has been released, there are always evaluations within the same profession. Inaccurate criticism should be dispassionately analyzed and dealt with appropriately. Both evaluations of excessive praise and criticisms of excessive harshness should be dealt with soberly. There should be neither blind joy nor utter disheartenment. Evaluations of the achievements of others should be complete; in regard to one's own achievements, truth should by all means be sought from reality. Past publicity for some science research achievements in the past (including my own) has been exaggerated in places, which is of no benefit to the individual nor to the development of science and technology.

4. Carry on scholastic democracy, and promote the contention of a hundred schools of thought. We must respect the theories, comments, and opinions of others, and we must dare to express our own differing opinions. Debate and cooperation can exist together, they are not contradictory. Where debate can continue in academics, then relations between individuals can still be close, and there is no shortage of precedents for this in the history of science both in China and abroad. At present, under the influence of unhealthy tendencies in society, in scholastic appraisal within professions in academia, including replies to the theses of graduate students and course examinations, often feelings are not expressed openly. Problems and thoughts are not brought out, and this is not a scientific attitude.

Tang Aoqing is himself a scientist of high scientific morality, and the four standards by which to enhance the cultivation of scientific morality that he has proposed are simply a true written reflection of the quality of his own thought. Professor Tang is extremely strict in his studies, and the academic papers that he has written or that have been written by aides or graduate students under his direction, are all written with great care and deliberation, and published only when they are believed to be flawless. He greatly detests the hurried, irresponsible scholastic attitude. On one occasion, one of his graduate students from early in Professor Tang's career wanted to participate in an academic conference in Chengdu, and because time was pressing the paper was not prepared in time for Professor Tang to see it. Afterwards, Professor Tang discovered that there were some errors in data in the paper, at which time he offered a very severe criticism. After 10 years, the memory of this was still quite deep for this graduate student. When another graduate student was doing his graduating thesis, he falsified experimental data, and after repeated examination of the facts, Professor Tang

would not let him graduate. Professor Tang is sincerely considerate of his profession within academia, and he looks for people's strengths, offering his own faults. One year, his aide participated in a scholastic conference at another location, and an older gentleman in chemistry offered an evaluation of the work of Professor Tang to the effect that he had not brought his theory together with actual practice. His aide was far from convinced, and upon his return reported to Professor Tang. Professor Tang said that the opinion of this gentleman was correct and pertinent. Besides instructing his aide to respect the opinions of this older gentleman, he sent one of his own students to study with this gentleman, to study the techniques of experimentation, and this greatly moved the old gentleman. Professor Tang's democratic spirit has also deeply impressed people, as he always assumes a position of equality with others. Even when he is with his students discussing problems, he encourages them to argue. Once, one of his graduate students calculated an equation. After looking at it, Professor Tang felt that it had been calculated incorrectly, but his student remained unconvinced. Professor Tang asked the student to go back and recalculate the equation. After several days, when this student again saw Professor Tang he still maintained that his calculations were correct. Professor Tang laughed: "I also recalculated. Neither of our calculations was in error. I must thank you, for otherwise authority would have buried a method of calculation that was correct."

Strive for the "Three News," Pay Attention to Transplanting

In recent years, Professor Tang has had a great influence in scientific and technical circles with his discussions of the "three news" in science research, i.e., namely, new thinking, new methods, and new achievements, so we asked him to expand a little on this problem.

Professor Tang said that if in science research there were "one new" of the "three news," then there would still be creativity. In general, it is not easy to have all that is included in the "three news." In natural science basic research, the most important one is respect for new thinking, next to that new methods, and next to that new achievements. When there is new thinking, new methods will be found, which will then generate new achievements.

Professor Tang went on to explain that major inventions in science in themselves represent a kind of new thinking. For example, Newton's comprehensive 1687 work, "Mathematic Principles of Natural Philosophy," ingeniously brought together Galileo's laws of motion for physical bodies and Kepler's laws of motion for heavenly bodies to create Newtonian mechanics. However, expressing these thoughts by using the mathematic methods of the past could not provide quantitative relational formulae. This required a new kind of mathematic method. Newton created a new kind of mathematics--calculus. With both the new thinking and the new methods, this then produced a great number of new achievements in natural science research that broke open a completely new stage in the history of natural science.

Of course, some new thinking can also be shifted to existing methodology, and using existing methods to express new thinking can lead to the development of the former old methods.

Professor Tang also summed up his own experiences in quantum chemistry research to discuss the importance of the "three news" in science research. New achievements need not necessarily all have new thinking and new methods, for new achievements can similarly be achieved by drawing on the thinking and methods of others. For example, our research into "ligand field theory," intramolecular rotation, and hybrid paths has used the thinking of others, but made use of new methods to obtain new achievements.

Professor Tang pointed out strongly that application and development research, on the contrary, do not stress new thinking or new methods. This is because there are many projects in these fields that can be resolved with existing thinking and methods. Many scientific and technical problems in our four modernizations are problems that have already been solved elsewhere in the world. By transferring existing thinking and methods, and by integrating them with our particular conditions, we can solve these problems with innovation. Some people feel that applications research, and especially the development of technology, is a menial thing in which there is little creativity. This belief is one-sided. At present, we should improve our understanding of applications research and development research and do more work with economic results. To evaluate applications and development research by the standards of basic research, and to over-emphasize the "three news," will fetter us unnecessarily.

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NATIONAL DEVELOPMENTS

TRENDS, STRATEGIES FOR TECHNOLOGY MARKETS

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENCE OF SCIENCE AND MANAGEMENT OF S&T] in Chinese No 5, May 86 pp 12-14

[Article by Zhong Xijiao [6988 6932 5754] and Li Mengling [2621 1125 3781], Shenyang Municipal Science and Technology Commission: "A Tentative Discussion of Development Trends and Development Strategies for Technology Markets"]

[Text] Technology markets have changed from the vigorous and dynamic to the solid and firm, they have developed first explosively and intermittently to developing stably and continuously, and they have progressed from a low level to a high one.

The directions, trends, goals, and future for the development of technology markets are:

After release of the "Resolution by the Central Committee Regarding Restructuring of the Science and Technology System," development of the technology markets in this country entered a completely new stage. The scene was one of constantly increasing vitality, more and more technology contracts were signed, the financial amounts of transactions became larger and larger, and the economic results created got higher and higher. Their position and function were acknowledged by society. However, as the reform of the economic and science and technology systems progress and socialist economic construction flies forward, how our technology markets are to develop is a new question with which we are faced.

I. Getting Control of Development Directions in Technology Markets

In the first stage, technology markets in this country were operating quite vigorously. Trade fairs were held, research-production joint groups were organized, technology went door to door, and everywhere there were all kinds of activity. But recently, the permanent technology markets and exchange and trade fairs in some areas have not been all that "prosperous," and the financial volumes of technology transactions have not been climbing in a straight line. Why has this happened, and how should this problem be viewed? It is our belief that this is a new trend for technology markets, a condition that has been affected by four factors. One, what is now being sold at technology markets are achievements that have been accumulating for previous

decades without dissemination, and after a stage of exchange and transactions, the supply has not been able to meet the demand. But with the appearance of new achievements a certain period of time will be required, so currency sources are not great; two, this country has greatly reduced investment in basic construction and has correspondingly eliminated technology projects that were part of that investment, which has led to the fact that the rate of growth in the amounts of technology trade has not been fast; three, through party rectification and education and strict management of the markets, technology commodities have been put in order, and some items that are not technical and are non-essential have been kept away, allowing the commodities in technology markets to be more consistent; four, because money has become tight, loans for primary buyers of technical products, small to medium enterprises and town and township enterprises, have decreased, meaning that financial sources are insufficient. This has affected growth in purchasing power. In addition to this, there are also problems with organization and policy that have affected the enthusiasm among scientists and technicians. However, in this aspect these trends presage the fact that technology markets are changing from vigorous and dynamic "blustery markets" to solid and firm conventional markets.

Technology markets have gone from nothing to something, through a process of developing from small to large, and the commercialization of technology achievements has now been acknowledged by the majority of people, and the majority of units has become accustomed to technology trade activities. This has forced technology markets to undergo a change of form and of development speed. The direction of this change has certainly not been a full circle, where the commercialization of technology is denied and where the basis for technology markets is denied, but has continued to develop forward with a high degree of stability. Science research achievements resulting from the research of science research units will be released to the technology markets in time. When enterprises need a certain kind of technology, it will be purchased in time, technology projects will be put to bid in time, and technology trade will tend to regularize. Looking at things from this angle, the technology markets are changing from the vigorous and dynamic to being solid and firm, from an explosive and intermittent development to one that is stable and continuous, and have progressed from lower levels to higher ones.

II. Predicting Development Trends for the Technology Markets

Since technology markets have developed from lower levels to higher ones, what are their development trends like? By looking over the past several years, especially the trends for development of this country's technology markets since the publishing of the Central Committee's "Resolution," we believe that there will be the following changes in the technology markets:

1. There will be a change from a seller's market to a buyer's market. Because for a long time technology was not considered for exchange in this country, there was a group of technical achievements in the hands of colleges and institutions and of research units that had never been applied. In the first stage, what were operating in the technology markets were for the most part just these "ready made" technical achievements. Science research units could sell any achievements they had, and what an enterprise thought might be

of use they would buy, what could not be used they would not buy, so from the point of view of technology market operations, it was a seller's market. With the reform of the economic system and of the science and technology system, and with development of the commercialization of technology achievements, the requirements of production units for science and technology achievements have increased, and they have continued to propose new projects from the actual experience of production; science research departments have faced up to economic construction and undertaken research on these problems with some results that have caused the adaptability of technology commodities to be greatly enhanced. Technology markets will change from seller's markets to buyer's markets, which will further promote the closer integration of science research with production.

2. The Change from Completely Free, Unplanned Markets to Integrated Planned Markets, Semi-Planned Markets, and Free Markets. This is apparent in: 1) items from planning have begun to penetrate the technology markets. Items in planning for capital construction, transformation, and major projects for many provinces, prefectures, and counties have come into the technology markets in great quantities, where they are subject to bidding, goods are available from many sources, the best technology is searched for, from all of which the projects are effectively implemented. 2) A great number of general engineering contracts has been added, which has changed the past method in which only single technologies could be provided and where technologies had no regard for equipment. This has promoted the packaging of scientific research, design, and manufacturing construction. 3) Importing technology has shifted toward bidding on the domestic technology markets, where everything that can be handled domestically is not imported, and this has saved much foreign exchange. This kind of change for the technology markets objectively requires the inclusion of the technology markets themselves within the unified planning for invigorating circulation, for including shifts in the overall arrangements for advanced technology projects in overall arrangements, and for separate management as projects differ in nature. And relevant departments should develop and guide products in a planned way through the technology markets.

3. The Change from a Market of Low-Grade Products to One of Low, Medium, and High-Grade Products. Among the technology products currently available in technology markets, low-grade products are the more numerous. And buyers are largely small to medium enterprises and town and township enterprises. After these products are applied and transferred to the buying units, they have promoted the technical advancement of these units. But technical advancement in medium to large enterprises is increasingly important. At the same time as the technology markets are catering to small to medium enterprises, they also should cater to medium to large enterprises and operate with high-level or high-grade technical commodities. Therefore, the change in markets from operating solely with low-grade projects to markets operating with both short, even, and quick projects and medium and high-grade technical commodities is an imperative one.

4. The Change from Markets that Are Solely Domestic to Markets that Are Both Domestic and International. Because of this country's open-door policies, the technology markets have naturally become joined with world markets. In comparing the technical level of this country with that of advanced countries

of the world, we are somewhat backward, but in some areas our research is in the forefront. As the domestic technology markets develop, certain advanced technology in this country will enter international technology markets. This will open up new channels for exports and for generating foreign currency.

III. The Development Goals for Establishing Technology Markets

To adapt to the change by which technology markets have gone from low level to high level, and to welcome the advent of the next trend in the development of technology markets, we should study the corresponding development goals.

1. Primary goals for technology markets. In the near term, there are three primary goals for technology markets: one, disseminating applications for existing scientific and technical achievements; two, transformation of traditional technology and traditional industry; and three, the development of new technology and new industry. This will allow the levels of technology in the main industries in this country to be greatly improved.

2. The development of operations structures as a goal. As we rectify the basis of existing operations structures, technology operations structures throughout the country should continue to develop. If we are to gradually allow these structures to become actual structures for dealing with technology commodities, there will be rightful recompense for both buyers and sellers in technology trade, and this will ensure the smooth transformation of science and technology into direct production forces. Also, there will gradually be economic independence within a few years.

3. Goals for the system of technology exchange and trade. By relying on central cities, and having permanent technology markets as a core, there will be gradually formed a management system that is an integration of parts, an integration of the internal and external, and that has the capability of attracting and radiating, all of which will manage well and invigorate technology markets.

4. Goals for economic results from technology trade. Through various kinds of technology trade activities, there should be an annual rise in the financial amounts of transactions, an annual increase in income for technology commodity producing units, and an annual improvement in benefits for units buying technology commodities, which will allow technology markets to play an increasingly important role in economic construction in this country.

IV. Selecting the Paths of Development for Technology Markets

To allow technology markets to healthily and steadily develop toward goals already determined, we should select appropriate paths of development. Based on conditions for development for the technology markets and development trends, we believe that attention should be paid to solving the following four problems:

1. Actively support the production of technical commodities. The key to the speed at which technology markets develop is in the number of technology commodities and the degree of their quality. Therefore, in selecting paths of

development for the technology markets we should first of all consider whether or not they will be of advantage to supporting the production of technical commodities. This requires that we adopt policies of raising the chickens to produce the eggs, or giving first that we may take later. It requires that we guarantee a long uninterrupted flow for technology commodities. More specifically, preferences should be given regarding funding, taxation, and materials, problems with reproductive conditions and real power for research units should be solved, and we should motivate science research personnel, allowing them to advance into the breadth and depth of technology commodity production.

2. The circulation of technology commodities from science organizations. The circulation system of technology markets should suit the rapid transformation of technology commodities into production forces. To change the confused situation in the management of technology markets, we should both advocate operation by multiple entities and should also stick to unified leadership, for the nation is like a chessboard, and if planning is to consider the overall guidance, rules and regulations, and policies of technology markets, we cannot move from old fragmentation to new fragmentation. On the basis of the national leading small group for the coordination and guidance of the technology markets, each area should set up this kind of structure, where the science and technology commissions take the lead, where finance, taxation, banking, industry and commerce, justice, education, and statistics departments all participate in unified study of the question of the existence of the technology markets, coordinate relations in various aspects, and exercise overall control. Modes of circulation for technology commodities should not be all the same. Any moder should be provided as long as it benefits the circulation of technology commodities, the dissemination of achievements, and the generation of social and economic results.

3. Effective supervision of the expenses of technology commodities. We should use legal means to protect technology trade and to guarantee the smooth transfer of technical commodities, change the situation in which the policies for domestic technology markets are insufficiently uniform and from too many sources, and clarify the nature of technology trade and operational scope of technology markets. We should strengthen inspection of technology contracts, certification, and management, prohibit blind transfer of rights and plagiary, prohibit the entrance of counterfeit technical commodities into the technology markets, and protect the reputation and confidence of the technology markets. To do a good job of monitoring and management, within any area we should strictly distinguish the regions for the "development centers" and "consulting branches" official intermediary organizations that have been organized for each system from market management organizations. If we can similarly distinguish industrial and commercial administrative management bureaus for other markets from industrial offices and commercial companies, this will allow technology market management organizations to be as responsible as possible.

4. Conscientiously guarantee the transformation of technology commodities. The state should provide preferences for new products that have been developed through buying technology commodities, in the areas of tax deferment, repayment of loans, and retention of profits. The seller of technical

commodities should arrange for continued after-sale technical service to allow technical commodities be transformed into production forces as quickly as possible. Science research units that provide good follow up service and that have outstanding results should be rewarded, and the amount that is deducted for rewards for the scientific and technical personnel can be appropriately higher. When follow up service is not good and the contracted results cannot be realized, fines should be levied.

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NATIONAL DEVELOPMENTS

INTEGRATION OF RESEARCH, PRODUCTION DISCUSSED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENCE OF SCIENCE AND MANAGEMENT OF S&T] in Chinese No 5, May 86 pp 28-30

[Article by Xia Guofan [1115 0948 5672], Ministry of the Aviation Industry, Institute No 608: "A Discussion of the Problem of the Change in Thinking Regarding the Integration of Institutes with Factories"]

[Text] Eight Major Changes:

In planning management: change from research model to research operations model.

In research topics: change from technology model to technology and economic model.

In research methods: change from experimental model to experimental and production model.

In operating mechanism: change from administrative model to market model.

In research structure: change from military goods model to combination of military and civilian model.

In management system: change from vertical model to joint model.

In technology development: change from closed model to open model.

In talent development: change from specialization model to composite model.

It was pointed out in the "Resolution" by the party Central Committee regarding the restructuring of the science and technology system that "the fundamental goals for the reform of the science and technology system are to allow the achievements of science and technology to be rapidly and broadly applied in production, to allow the roles of scientists and technicians to be played out to the fullest, to greatly free up scientific and technical production forces, and to promote the development of the economy and of society." We can see from this that the great policy of our party is to realize the close integration of science research with production, of

technology with the economy, and to fully exploit the tremendous function of science and technology in our socialist modernization. This is at the same time the urgent task of science research units.

Resolving the integration of research with production will allow science and technology to be transformed into realistic, direct production forces, and must be realized through the dissemination and application of scientific and technical achievements in production. Therefore, the fundamental goal of science research and its final end lie in the dissemination and application of scientific and technical achievements. Looking around at various countries of the world, it can be seen that they highly regard the dissemination of scientific and technical achievements. We can see from the application rate of achievements that in the United States and Japan it is 80-85 percent, in England, France, and West Germany it reaches 50-60 percent, and even in the Soviet Union 30-50 percent, while in our country the formerly limited technical achievements were only applied at a rate of about 10 percent, as the facts show. We must increase the pressure, motivation, and vitality for research organizations to orient toward economic construction, and improve the rate of application for the achievements of project research, and bring benefits to the development of the economy and of society. To this end, research units must change in regard to their thinking and ideas, traditional habits, forms of leadership, and working methods.

I. Changing from a "Research Model" to a "Research and Operations Model" for Planning Management

In the past, science research units were stuck in a passive state where "planning issued from the top, funds were provided from the top, losses made up by the top, profits taken in by the top," wherein they lacked the motivation and pressure to integrate with production. Now, as the state is implementing prescriptive planning for major research projects, it has been decided to use prescriptive planning, economic levers, and market regulation for management. We must fully utilize the conditions of delegation of authority and of invigoration to change from the traditional "research model" to a "research and operations model." The concept of technical operations should be strengthened from research institute director to the scientists and technicians and to the management cadre, there should be proficiency in operations management knowledge from research to production, from technology to economics, from putting into production to its results, and from production to circulation of the products. This should become an understanding of things at the time they happen, and throughout everything there should be an underlying "open model" of operations management.

To realize this changhere should be an
underlying "open model" of operations management.

To realize this changdetermine the goals
of technology operations based on the "two things surrounding." One of these is centering on high standards, laying a foundation, supporting the needs for reserves, emphasizing the intensification of long term prepatory studies, and doing a good job at technical preparations for developing new products characterized as "high level, accurate, and sophisticated." The second centers on the needs of the technology markets and of users, and puts its main force into solving the key problems of practical economic construction and

economic development. If, as this institution completes preliminary studies of topics as provided by the state, we also develop bread automation lines, rail flexible shapers, and a production line for Chinese medicine, this would allow science and technology to quickly become production forces. And working in this way both suit the needs of long range development of production, and also satisfies the needs of contemporary production. To the greatest extent possible, it considers the problems of integrating research with production from the point of view of operational strategy.

II. Changing from a "Technology Model" to a "Technology and Economics Model" in Project Research

To change the situation in which for a long time research units "ate from the big pot," where overall income and expenditures, real repayment and real sales, and the length of development time were of no concern, nor the number of achievements applied, we must enhance cost management and economic accounting. By changing from the "technology model" to the "technology and economics model," we will meet the requirements of less being put into investment, more produced, low expenditures, and high benefits. Therefore, when we are selecting research topics we want to both respect technical demonstrations, and also do good economic analyses, combining technical advancement with economic rationality. When we are implementing those projects we should use value project accounting and analysis and should check the expenditures for human labor and for material labor, to the best of our abilities accomplishing an optimal integration of high performance with low costs. When supervising achievements, we should both respect their theoretical significance and scholastic level, and also economic results and socio-economic results. The facts have shown that all technology that is suitable in having a short materials turnaround and obvious economic results can be welcomed by production units. As for example our research into new techniques and equipment for ramie degumming, where technologically we have attained the international advanced standard of degumming and evaporation in 1 hour and a production period of 1 day. A degumming plant handling 3,600 tons annually can make more than 1.5 million yuan in profit each year, can have a strong competitive capacity and capacity for generating foreign exchange. It will therefore become a technical "hot item" on the market, with unrelenting demand.

III. Changing from an "Experimental Model" to an "Experimental and Production Model" in Research Methods

When research units develop a new product, create a new technique or method, or provide a certain kind of technical service, this is all to get them into production, then to go on and get them into circulation. However, because in the past there was no compensated transfer of rights, but an emphasis on experimentation and disregard of dissemination, many research achievements stayed as samples or exhibits. To hasten the transfer of research achievements from the laboratory to production, to change samples and exhibits into products and commodities, and to enhance the making of research achievements into projects or commodities, we must change from an "experimental model" to an "experimental and production model":

1. As we purchase test instrumentation and experimental facilities, we should also consider the needs of small scale production, replenishing key equipment, and perfecting small production line outfits so that the institute can have both the means for experimental research and also the capability for commercial production.

2. Strive to undertake the lesser testing in one's own laboratories and do progress testing on the trial production line, which will save on development expenses and will reduce change-overs in mid-stream, hastening the speed of development periods and of getting things into material form.

3. Make use of the trial production line for the batch production of scientific and technical achievements that are technology intensive. This will both generate income for the economic independence of the institute and will also transfer to the production units the verified conditions for the creation of finished products.

4. Treat difficulties in the reality of production as topics for scientific experiments, where both "production" and "sales" meet. As for example where this institute did experimental research on the key to quality in which tail temperatures in a batch of produced turbines deviated 5.3 percent above specifications. We found a new way to change the angle of installation of a compressor rectifier that would adjust the distribution of the turbine tail temperature pattern, and the temperature was lowered 4.2 percent below specifications; for a rectifier that had trouble starting when on a plateau in great cold, we did hundreds of simulations and experiments in the laboratory. From this we obtained an optimal range for gaps that would affect ignition performance. In this breakthrough of a technical difficulty, we cleared up some problems in production, receiving the heartfelt praise and welcome of the production factory.

IV. Changing from an "Administrative Model" to a "Market Model" Regarding Operating Mechanisms

The technology markets are an important means by which to promote the integration of research with production. In the past, because research achievements were not considered commodities, we were used to managing science and technology by administrative means and we lacked the mechanism of market regulation. This made research units feel that "service led nowhere" and production units to feel that "there was no use seeking help." To change this phenomenon of the "two shells" of research and production, research units must change from an "administrative model" to a "market model."

To open up the technology markets and make technology trade prosper, research units will take a realistic look at the way they do things, will keep an ear open for news, will actively participate in hierarchical, multi-channel, multi-format technology achievement trade fairs, will open up technical stores, will sponsor release conferences for technical commodities, will establish channels for the exchange of market information, and will organize technology consulting services. This will allow their own technical achievements to enter areas of circulation, will allow production units the free choice of purchases of appropriate technologies and achievements in the

technology markets, and will also allow research units to take in information about societal needs in a timely manner. As for example where this institute participated in technical achievement trade fairs in the first half of this year in Hangzhou, Beijing, Jilin, and Changsha. The volumes of intended purchases always averaged 2 million yuan and more, especially for those "short, even, and quick" technical achievements that saved on investment, used little energy, and saw rapid results, business in which was brisk, both in buying and selling. Therefore, it is more or less reasonable for people to think of technology markets as "golden bridges" linking research and production.

V. Changing from a "Military Goods Model" to a "Combined Military and Civilian Model" in Research Structures

According to the principles of military and civilian integration and of safeguarding the military while shifting to the civilian, our national defense science research units should break up the organizational structures that separate the military from the civilian. They should both accept the great responsibility of building our national defense and also work for the people's living and national economic construction by changing from a "military goods model" to a "combined military and civilian model":

1. Newly established military industrial science research units should design and build in accordance with the requirements of military-civilian integration and of peace time integration, which will allow national defense science and technology institutes to have the two functions of serving both the military and the civilian.

2. In the planning and design of research projects, demonstration and development should be in accordance with the requirements of use by both the military and civilian, concurrent use, and shared use, in order to expand the scope of use for military industrial commodities.

3. Transfer scientific and technical achievements through various channels to departments of civilians use, as for example developing goods and technical equipment, providing technical software, taking on technical consulting, developing technical services, passing on technical secrets, joining in the importation of technology, and training technical talent. There should be a special effort to develop research into multiple uses for aircraft. The "function exchange" of aircraft engines can be widely applied in motive equipment like ground generators, natural gas recoverers, railroad engines, and mining and drilling fire extinguishers. The antennae of military industrial institutes can be extended to all fields of civilian departments to open vast new ground for the integration of military industrial research with civilian production.

VI. Changing from a "Vertical Model" to a "Joint Model" in Management Systems

In the past, research and production each had its own "grandmother," there was vertical management, isolation, achievements of research units were hard to disseminate, and it was hard for production units to renew their products. Therefore, research and production should tear down the walls and fill in the

ditches, relations should be improved, there should be mutual benefit based on equality, economic authority, mutual acceptance of risk, and a spirit of equal sharing of benefits. There should be both vertical cohesion and lateral communication, and there should be a change from column after column of "vertical models" to the lateral "joint" model. There are currently several different forms of association with this institution. One is "factory-institute integration type," where technology is the connection and product the result; a second is the "technology-industrial-trade synthesis type," where research, design, production, sales, and service are unified; a third is the "multiple in-law type," which is jointly managed by different units and crosses administrative, regional, and departmental boundaries; a fourth is a "pooled resource joint capital type," where technology and money are invested for shares; a fifth is the "international cooperation development type," developed with cooperation abroad; a sixth is the "interconnected conditioned type," which depends upon products and where the leading unit is the "dragon head." Each association is like a node, where the strengths, advantages, and vitality of each member are brought together, both allowing research to have found the "passageways" through which to communicate, and also allowing production units to have found a "large tree" against which to lean. We will let things go as they will, will follow the advantages, and will emphasize the use of economic levers and economic rules to lead research-production associations in a development from the loose to the intensive, from the short-term to the long-term, from the single to the diversified, from the initial stages to the higher levels. This is also a process going from "wanting others to join" to "others wanting to join," and from "physical changes" to "chemical reaction."

VII. Changing from a "Closed Model" to an "Open Type"

Looking at all the countries of the world, all uphold an open-door policy. They take the strengths of science and technology in the world for their own use by which they can improve the starting points for their research and hasten advances in technology and the development of the economy. The Japanese have a phrase, "comprehensiveness is creativity." They have imported foreign advanced technology in great measure, have fully absorbed it, and have integrated it with their own technology. They have improved it, brought other things in, and raised it to a more advanced technology. Look, for example, at the Japanese steel industry, where in the 1960's they imported the "6 major technologies" from the United States, France, and Australia. Through comprehensive improvement, they created the trans-furnace unburned waste gas technology, until by the 1970's they were exporting the technologies abroad. Therefore, our research units should change from the blind and deaf manner of the past, fettering ourselves in our own efforts, and change from the "closed model" to the "open model," and based on the principles of "self-direction, selecting from the best, merging and cohesion, and weeding through the old to bring forth the new" to bring in, learn from, and study to the best of our abilities the newest technical achievements in the world and the follow up technology. We will develop and innovate on the basis of absorption and assimilation, and impart Chinese characteristics. In this way, we can better suit the technology transformation of traditional industry and the needs of developing rising new industries. As for example the jianhua and tatami machinery this institute imported and on which we did a technical synthesis

and "function attachment," developing an automatic shajing machine. In the first trial run, 34 were made, and after more than a year later 2.2 million have been produced. The shajing straw mat that is woven has been judged to be first in quality among products of that industry, and has received certification as being top quality. Drawing on the experience of the gas pressure-scanned system technology of the American (Liuyisi) company, we went on to develop a similar instrument with measurement accuracy 0.16 percent better, that within a few seconds can at one time test from 100 to several hundred stable pressure parameters, and which has been quickly applied in experimental measurements. The facts have shown that by opening up the gates, opening to the outside, gathering together the strengths of many, and opening up new applicable technologies that have high standards, high efficiency, low cost, and low energy consumption, we can be noticed by production units and our technology adopted, and the integration of research with production is no longer doubtful.

VIII. Changing from a "Specialist Model" to a "Composite Model" in Talent Development

Because in the past the labor of specialties was excessively differentiated, for a long time scientists and technicians were caught in a single specialty. Other ideas were always closed off and knowledge was narrow, even being divorced from production and reality. Looking abroad, personnel often have contacts, exchanges, and movement between specialties. In the United States people change their professions at an average rate of 10.2 per year, and in West Germany it is 2.8. People have predicted that by the end of this century and the beginning of the next, it will be a new era for intersecting disciplines. There will be more blending of natural science with the social sciences, there will be more contact between basic science and the applied sciences, and production specialization and production cooperation will come even closer. Scientists and technicians must have a broad education. With an emphasis on one specialty, be conversant with neighboring ones and related specialties. By changing from a "specialist type" (or single type) to a "composite type," we can achieve both an understanding of technology and an understanding of economics, both an understanding of design and an understanding of technique, both an understanding of machinery and an understanding of electricity. We will cultivate a composite type of talent that suits the requirements of economic, scientific and technical, and social development. This will improve the "transformation" capability to transform technology into products, intelligence into production forces, and knowledge into wealth. When scientists and technicians have compounded their technology, this will fundamentally create the conditions for the application of scientific and technical achievements in production.

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NATIONAL DEVELOPMENTS

FACTORY, INSTITUTE INTEGRATION DISCUSSED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENCE OF SCIENCE AND MANAGEMENT OF S&T] in Chinese No 5, May 86 pp 24-25

[Article by Tang Ding [2768 0002], Research Laboratory of the Ministry of the Aviation Industry: "Integration of Factories With Institutes Is a Good Form of the Integration of Science and Technology With the Economy"]

[Text] The integration of science research with production has brought fully to bear the function of science and technology in our socialist modernization, and is a strategic policy of our party. As the reforms of the economic and science and technology systems progress, the integration of science research and production, and of factories with research institutes has already reached agendas, and we must accomplish this integration of factory and institution opportunely and reliably.

There are relations of all kinds between science research and production, and there is mutual reliance and mutual functioning. It is an organic entity.

The integration of factory and institute is an objective requirement for hastening the development of new products. Everyone knows that the design experience for products comes from production, in which the quality of product is very important. Good designs must take into consideration accumulated knowledge from the production lines, and must as well integrate problems in the process of usage, apply new and previously created achievements, and at the same time, after the fact, must return to production for testing. Therefore, if science research is divorced from production practices, that makes a river without a source, a tree without roots.

Factory-institute integration designers must understand directly technical problems that regularly occur in the production process, and also be able to better gather together the wisdom of the vast number of workers, so that the design can be closest to reality; by understanding the entire development process, production departments can control key links and can make production preparations as early as possible, which allows research development and production to be better linked. In this way, the processes of turning over and returning to the factory can be greatly simplified, which aids the rapid change to batch production after product design has been finalized. If trial production and production are not at the same factory, it is bound to be

turned over after all the voluminous blueprints and technical materials have been finalized, and also there will be top-down duplication and moving and installation, which will affect and delay the time of batch production.

In addition, integration of factory and institute will be beneficial to the building of research and production units and to technology transformation, and will achieve unified planning and unified arrangements. This is especially true for some high precision large equipment, which can be used by both the factory and the institute. This avoids each having a set, which creates duplication and waste.

The integration of factory and institute is a good model for the evolution of the factory from a production model to a managed development model.

Enterprises abroad highly respect science research, and use a greater part of revenues for research expenses. Large companies generally lack organizations that just manage research development, for they themselves and factories at lower levels have institutes of a certain scale (or offices of research and development). Many large companies do not hesitate to spend huge sums in their institutes for technical transformation, expansion, and consolidation. They set up science and technology centers to produce new products and create name-brand products; they develop large scale equipment and entire sets of equipment; they formulate and execute major long range development plans for technology; and they undertake international cooperation, as well as take on science research tasking. In this way the company can quickly complete the designs of new products and production projects based on their own production conditions, and at the same time accelerate the constant renewal of production technology. This allows product quality and performance to improve constantly and become increasingly competitive in the marketplace.

Many industrial enterprises in this country are now changing from simple production models to managed development models, and in this process they must closely depend upon science and technology. Hastening the pace of factory-institute integration allows scientific and technical achievements to be used in production as quickly as possible, strengthening technology absorption and development capabilities of enterprises.

The integration of factory and institute creates advantageous conditions for making businesses out of science research units.

Formerly, the state placed no economic demands on science research units, each year allocating operating expenses based on the organization and number of people. Little attention was paid to economic results, nor was there economic analysis of technology. Even though science research units published many papers and studied and designed new products and technologies, because they lacked trial production means that made them hard to produce, economic results were quite deficient. After the integration of factories and institutes, science research should both consider the long range needs of production and solving problems in current production. In the process of creating economic and social results, they will gradually reduce their reliance on the state, eventually realizing the making of science research units into businesses.

In addition to this, the integration of factories and institutes is also of advantage to the implementation of system project management; it is beneficial to changing development expenses from an allocation system to a contract system; it is beneficial to enhancing lateral relations and coordination.

The process of quickening the integration of factories with institutes, and actively creating the conditions for that integration.

At present, factory and institute integration is proceeding slowly, many associations are loose, and how we are to develop loose types into intensive types, and how we can amalgamate the corresponding factories and institutes, are important questions. Realistically, there must be the following conditions for the intensive integration of factories and institutes:

1. Factories and institutes should have shared tasking, which is a premise for integration, and especially for the development and production of products. Only if the goals and tasking are the same can there be a strong inner cohesion for integration, and can mutual benefits be closely bound by this link of shared tasking. In this way, we can easily achieve the concept of similar minds and similar actions, where thing and actions are the same.

2. If primary leaders have a strong sense of science research and can carefully handle the relations between science research and production, this is a key to whether we can successfully integrate. If primary leaders lack a strong sense of science research, and lack a consciousness of reliance on the progress of science and technology, it is then possible that after the integration there will be a tendency to favor production over science research and to favor the current over the long range. Contradictions will occur in the integration of factories and institutes, and there will be setbacks. Therefore, at the beginning of the integration of factories and institutes it is a very important thing that there be an earnest selection and respect of science research, as well as that there be primary leaders to take charge of the companies who are people capable of leading science research.

3. That enterprises have a certain amount of real economic strength. Through the integration of factories and institutes there can be a quicker renewal of products, development of production, and better economic results can be had, which will allow constant growth of benefits for the staff of enterprises.

The integration of factories and institutes has a dual significance of being of the reforms of the economic system and of the science and technology system, and there must be both enthusiasm and stability for the integration, which definitely cannot be done all at once.

1. Take enterprises and companies as the basis of new product development. When existing conditions in current product designs are mature, they should be merged with the corresponding factory. The factory can be merged with the institute, or the institute with the factory. The institute will in truth be the development department of the company, and the factory and institute will join together to comprise an economic entity with legal qualifications.

After the merging of factory and institute, design capacities of both parties will be used together. As for materials, reserves, and benefits departments, there can be a transition under the unified leadership of the company, both existing for a certain time. Attention should be paid to providing the company development department with more autonomy. Development of the enthusiasm of the research units should not be restricted because of the amalgamation, and entitlements formerly enjoyed by the institutions should for the most part be continued by the company.

2. To create conditions for integrating factories and institutes, the tasking of factories and institutes should be adjusted to make them as similar as possible. Because factories are enterprises and institutes institution, remuneration is not the same. This should be earnestly studied and measures should be adopted to handle and resolve this. After the merging, the staff of the institute will gradually draw closer to the enterprise, and wages and bonuses should float with the rise and fall of enterprise economic results.

3. In the process of reform, organizational structures in companies and the factories and institutes will restructure at the same time. Except where there are some levels of units at lower levels relatively independently operated (factories and branch factories), companies should set up development departments to be responsible for technology development; they should establish manufacturing departments to be responsible for organizing production. Company leaders and organ cadre will consist of personnel from both the factory and the institute, to be used according to their abilities. There should be mutual exchange between cadre.

4. In the process of system reform, work in political ideology should be done well, and the important significance of the factory-institute should be explained clearly in principle; control the organization of structures, and have a complement of cadre; control product development and technology transformation, and efforts should especially be made to set up both separate and joint test production lines; control the expansion of benefits and remunerations for staff and cadre.

5. In view of the fact that factory-institute integration has the dual significance of being reforms of both the economic system and the science and technology system, and moreover that science research is certain to have its own rules and characteristics, things are somewhat complicated and wide-ranging, and should be carefully handled. There should be more investigations, more research, more experimental sites, and everything should not be done at once or all in the same way.

6. Upper level management organs should support this reform. Consideration should be given to appropriate preferences for both parties, and some necessary adjustment measures should be adopted for support. Investigative groups should be organized to earnestly look into and truly solve relevant problems, and should accomplish this enormous tasking together with the company or enterprise.

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NATIONAL DEVELOPMENTS

BENEFITS OF RESEARCH, PRODUCTION ASSOCIATIONS EXPLORED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENCE OF SCIENCE AND MANAGEMENT OF S&T] in Chinese No 5, May 86 pp 16-17

[Text] Science research and production associations are an intense form of the technology market. This kind of association can form a technology development system that is a rational package, can constitute a stronger comprehensive problem solving and manufacturing force, and is an inevitable tendency.

As our reform of the agricultural and urban economic systems develops, hierarchical, multi-channel, and multi-form "technology markets" are springing up in this country. They have not only opened up channels through which technological achievements flow toward production departments, but have also become a regular bridge by which to link production requirements and science research activities.

Primary forms of technology markets in this country include: 1) self-determined, mutually dependent relations between research design departments and production units, compensated transfer of rights to scientific and technical achievements, and technology coordination services that have broken up the situation of the past whereby for a long time only administrative means were used to disseminate scientific and technical achievements. This has also allowed the economic benefits of research organizations to be joined with those of production units. 2) Various kinds of technical exchange trade fairs, which have in a planned and organized way allowed the two parties, need and supply, to meet directly in a broader context, facilitating the exchange of information, and holding talks about a profession, which have played outstanding roles in promoting scientific and technical exchanges. 3) City or regional science and technology development exchange organizations and consulting service organizations. This kind of organization is often composed of a combination of science research units and higher institutions, where those that are served are not restricted by administrative systems, the range of services include scientific and technical development, scientific and technical consulting, transfers of rights to and exchange of achievements, the exhibition and sale of new products from science research and of imported samples, and the cooperative joint use of large-scale precision instrumentation. 4) Permanent technology markets are products of the reform of our economic system and of the development of production of commercial

products. They have fixed locations, specialist operations personnel, exhibitions throughout the year, those in need and suppliers can meet for talks at any time, and there is plenty of time for demonstrations, all of which aid transactions. They can also directly operate buying and selling operations for material technology achievements, that is, technology transaction locations are also technology stores, with the qualities of material commodities markets. 5) It is worth pointing out the periodicals and journals that have recently begun publication and are concerned with technology markets and scientific and technical consulting. These have been good for promoting the linking of colleges and science research organizations with production departments.

The development of technology markets in this country has already exhibited some new trends and characteristics: 1) developing from simple transfer of rights to technology to joint development of new technologies and joint operations; 2) developing from technical cooperation between units to long-term technical cooperation between departments and provinces and cities; 3)developing from sole use of domestic technical achievements to an integration with imported foreign technology, and to an integration with an absorption of and innovation to imported technology; 4) developing from fragmentary projects outside of planning to systematic projects within planning; 5) developing from the sale of single technologies to sets of technologies or contracts for entire engineering projects; 6) developing from sales of technology involving buyers, sellers, and intermediaries to where various financial units like banks and investment companies have entered the technology markets together, and using funds and credit to support projects in technology market transactions have caused the technology markets to begin to join with the financial markets.

An analysis of current conditions for transactions in technology markets shows that the majority are in product design or in technical directions, small investments with quick results that are suitable for town and township, group, and small-scale enterprises; some projects are of a higher technical level, but are very limited regarding the requirements of production capabilities. They cannot constitute a large production scale, and cannot easily attract the interest of medium to large enterprises. Although medium to large enterprises are only 1.45 percent of the total industrial enterprises in this country, their fixed assets are 65.4 percent, their taxes are 65.1 percent of what is turned in, they have a rich production base, also have technological capabilities, and are the pulse of the national economy. This being so, depreciation of the fixed assets of these enterprises has reached 50 percent, equipment is old and obsolete, and production and techniques are rather backward. They have realized that if they are to be major powers in future economic progress, their technology must be renovated and their products renewed, and that it is no good if they cannot depend upon new technology or upon science research from outside the enterprise. There are three characteristics of their current technology requirements: 1) they hope that their level of technology can be higher, that they can constitute large scale production capabilities and key products; 2) they hope that their technology can be complete, including blueprints, techniques, standards, testing, etc.; 3) they want both hard and software, including electro-mechanical equipment, even entire sets of production lines, their needs and absorption of technical

software always being manifest in the need for and importation of entire sets of equipment. These supply and demand contradictions are also reflecting from a new angle the fact that science research and production are unmatched. This is because, on the one hand, we have nearly 5,000 different independent research organizations in which it may be said that overall the specialties are pretty well represented, talent is reasonably concentrated, and testing equipment is also fairly complete. As we said above, under the stimulus of the reform of the systems they have great expectations for catering to the economy and serving production. However, many "independent research organizations" constituted a fatal weakness in the former systems, namely, that they are highly specialized, but lack comprehensive problem-solving capabilities and capacities for test production. They could themselves solve problems with any of the links in medium to large enterprises, but if they are to truly independently satisfy the needs for technological renovation in any particular profession or medium to small enterprise, there are definite difficulties.

Among new trends in technology, as there is contact between science disciplines and industrial disciplines, if new directions are not taken, then it will be even more difficult to adapt to the needs of modernization. Therefore, "association" is a path that must be taken. In recent years, the explosive development of science research and production associations in this country has not been accidental. They are an intensive form of the technology markets. Association in various forms has helped effectively concentrate the advantages in various aspects of the talent, funds, experimental equipment, and science and technology of science research organizations and production enterprises, as well as of their production equipment and production experience. This has allowed for a close joining of links between science research, testing, and production, for resolution of the contradictions of mismatching discussed above, for constitution of a technology development system that is reasonably complete, and for the formation of a stronger, comprehensive problem solving capability and creative capacity. Faced with real problems in industrial production, attracting a large number of relevant science and technology organizations and colleges and universities to the environs of production enterprises and link them up, is the most practical path by which enterprises can strengthen their absorption of technology and development capacity. This can not only provide the technology and equipment for key enterprises or professions in our national economy and improve the standards of technology, but can also allow each research organization to make the most of its strengths and supplement its shortcomings, greatly reduce science research turnaround time, and accelerate the development of science and technology. With science research and production joined together, that will naturally allow both parties to enjoy close joint benefits, will allow the "orienting" and "reliance" concepts that have been proposed by our government to truly become internal demands and self-conscious ideas for science research groups and production enterprises, greatly improving consciousness and enthusiasm for these aspects. Because of the joint benefits that reside therein, science research will naturally proceed from reality to fundamentally resolve the problem in the past of "the two shells." And consequently, will truly put the work of these science research organizations on the track of economic construction, and they will become great enterprises, especially as a base for the technology development of medium to large

enterprises. We realized all this after going astray for awhile. This is not only an effective way to solve contradictions of supply and demand in contemporary technology markets, but is also an inevitable tendency and joint direction for the reforms of our economic and science and technology systems.

With the incessant improvement of our production forces and the continued intensification of reforms of the economic and science and technology system, science research--production associations will be at first easy, getting more difficult later, gradually developing from small to large, and from relaxed association to concentrated unity. At first there will be a department of a university or a teaching and research section joining with a particular factory, or the institute of a science research organization with a factory, or an institute and several factories, or many factories with one institute, or an institute with the workshop of a particular factory, all in a loose form of association. They will divide up profits, jointly research new products, and on the basis of association will gradually come together. Or, a research organization will merge with a production enterprise, or an enterprise will merge with a research organization; some will have the factory subordinate to the research institute to become the experimental factory for the institute, giving the institute stronger conditions for testing, and gradually developing into a research and production type enterprise; for others, when operating jointly as small to medium enterprises, relevant research institutes and design departments will participate, and by operating the research departments of several factories jointly, can form technology development organizations for joint production enterprises. At present, multi-faceted technology cooperation or joint operation has already happened between colleges and research organizations on the one hand and production enterprises on the other; the characteristics of this form of association are that member units joining in the joint operations and cooperation are still "legal entities" as units, independently run and accounted. But external to this, they can uniformly operate jointly while accounting separately. This mode allows each participating unit to gradually separate from its managing department, breaking up the restrictions of "fragmentation" and fully exploring the advantages of association, exhibiting their strengths and supplementing their weaknesses. After production technology and management levels have improved, some will have evolved to research and production association entities that are closely integrated. Then, through this entity, the links of research, development, interim testing, test production, production, and market penetration will become unified, promoting the establishment and development of rising new industries.

In summing up the actual practice of forming science research and production associations, the following points are worth noting:

On the basis of upholding the principle of free will, there must be a certain amount of administrative organization and interference. In this country, regional and departmental affiliations for production enterprises and research organizations are a great obstacle to establishing science research and production associations. To break through these affiliations, there must be planning and rational deployment by state organizations from the top to the bottom, and administrative promotion.

On the basis of sticking to mutual aid and benefit, we must stress an energetic coordination. Safeguarding the mutual aid and benefits of member units through various forms of economic contracts are the economic bonds by which the associations solidify, sustain themselves, and by which they develop. However, in strengthening close coordination between the members, there are many problems outside of economics that require coordination and style, which is the ideological basis for the development of associations.

On the basis of upholding science and technology as serving production and the markets, we must stress that research go forward. Practice has shown that science research and production associations should open new aspects, should receive greater economic results, must put research in the forefront, and constantly produce new achievements. Research and production associations can be distinguished by the obvious signs of general industrial companies or production associations, that is, they must have strong capabilities for technology development, and the technical level of products should be in positions of leadership.

Currently, there is urgent need to better resolve particular policy questions for research and production associations, as for example taxation, credit, compensated transfer of rights, the division of income, etc., to benefit the further perfection, solidification, and development of these new alliances. We should on this basis formulate rules for research and production associations in this country, and using legal means, guide, support, and stimulate the growth and maturity of China's research and production associations.

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NATIONAL DEVELOPMENTS

MORE STUDY OF TECHNOLOGY IMPORT POLICIES URGED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENCE OF SCIENCE AND MANAGEMENT OF S&T] in Chinese No 8, Aug 86 p 1

[Text] After the Second World War, the international technology shift became an important factor in the economic development of many countries, it became an important foundation upon which to formulate national economic development models and structures, and it also became an important aspect in the international trade of many countries. As many countries were drawing up plans for economic and scientific and technical development, they were certain to consider the technology shift as an important strategic goal.

China is a developing country, and if we are to quickly develop our national economy and catch up to the developed countries, we must import advanced foreign technology in a planned way. To this end, we should enhance our study of technology import policies to formulate a correct overall strategy for technology imports and corresponding policy rules and regulations. This will hasten the rate of application and the pace for our importation of technology, allowing the importation of technology to achieve even greater substantial results.

The world is a large system. Development of the economies and science and technology in all countries is always within this dynamic system: some countries have developed and some are currently backward, and some sell technology and some import technology, which is an objective law in the development of things. Since the founding of this nation, we have actually violated those objective laws because of long term persistence in keeping to ourselves and the bias toward being "self-reliant" in everything, which has led to a lengthening of the gap between our economy and science and technology and that of many other countries in the decades after the war. Since the 3d Plenary Session of the 11th CPC Central Committee, we have implemented in this country the principles of an open-door to the outside and an invigoration within. People have realized that the importation of technology is a strategic policy for hastening the improvement of the levels of science and technology in this country, for strengthening our capacity for self-reliance, for invigorating our national economy, and for realizing our "four modernizations." The importation of technology has now developed more quickly. In recent years, we have gone from sole importation of entire sets of production equipment to importing single particular technologies to serve

the technical transformation of enterprises; we have developed from individual concerns talking with outside interests to the operations of multiple concern industrial and trading companies and credit companies; as the scales of importation have continued to grow, the modes of importation have developed from simple purchases of equipment to various forms that include licensing trade, science and technology cooperation, cooperative production, and technical advising. Technology imports have played an important part in economic construction and scientific and technical development in this country in recent years. According to incomplete statistics, by 1984 more than 1,700 technology items had been imported through the China National Technical Import Corporation at a cost of more than $3.9 billion. More than 4,000 items of various sorts have been used in the technical transformation of enterprises, at a cost exceeding $3.3 billion.

However, there are two sides to everything: there are many problems with technology importation in this country at present that are in urgent need of resolution. For example, 1) systems are fragmented and many interests are acting independently in their dealings with the outside. Structures for managing the importation of technology are repetitive. There are currently more than 200 companies that may operate import trade. From the largest major national project down to enterprises run by towns, townships, and communes, all are running their own imports, which has led to the wasteful practice where many different interests are spending foreign exchange and where projects are duplicated. 2) There is a lack of unified plans and policies. Because there is no unified management department responsible, there is a lack of overall strategic planning and direction, and of policies that control national technology imports. Currently, technology importation in this country is largely blind, whether from the point of view of overall structure or of project selection, and there is a lack of full and complete argumentation. 3) There is too little absorption and assimilation, and the rate of application for imported technology is too low. Because of a one-sided stress on bringing in hardware equipment and seeing quick results, software imports have been neglected; absorption and assimilation after importation lacks intensive planning and coordination, policies are incomplete, and the process of nationalization is slow. Aside from this, corresponding policies and regulations, as for example the formulation and adjustment of tax, credit, and pricing policies cannot yet keep up with the pace of technology importation and absorption and assimilation; attention is paid only to importation, export for foreign exchange being neglected. This series of problems can only be solved by a full scale, systematic, and scientific study of technology import policies.

For this reason, we must now greatly strengthen our study of technology import policies to allow for the true and organic integration of technology import planning, science and technology development planning, and technology transformation planning. Importing and absorbing foreign technology from a higher starting point will hasten the pace of nationalization; make full use of research units and higher institutions in the importation of technology and in its absorption and assimilation; handle well the relations between technology importation and domestic research, which will allow technology importation in this country to develop along correct lines and work as it should for our drive toward "the four modernizations."

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NATIONAL DEVELOPMENTS

RESEARCH UNITS' ROLE IN TECHNOLOGY IMPORTATION DISCUSSED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENCE OF SCIENCE AND MANAGEMENT OF S&T] in Chinese No 8, Aug 86 pp 2-4

[Article by Bai Yiyan [4101 0110 6056], Chinese Development and Research Center for Science and Technology Promotion: "Technology Imports and Domestic Science Research"]

[Text] Technology imports should be closely integrated with domestic research and development. Only by importing on the basis of existing science research and technology development, and only by absorbing, assimilating, and developing innovations on the basis of importation can we allow imported technology to bring greater economic and social results, and can we truly improve our autonomous development capacity, reducing the gap between us and advanced countries.

In recent years, technology importation in this country has developed greatly. In the aspects of promoting the technology transformation of enterprises, developing new commodities, and promoting technical advances by enterprises, the imported technology and certain key equipment have played important roles. However, we should be soberly aware that in comparison with meeting the needs of the challenge of the new world technology revolution, there are still some major gaps in our importation of technology. Besides lacking long range planning and the problems of too many voices and duplicate imports in management organizations, the separation of importation from domestic research and development is a very urgent problem.

I. The disparity between technology imports and domestic science research was first apparent in lack of links between import planning and science and technology development, and in the fact that import projects were not coordinated with key science and technology projects.

For example, the Physics Institute of the Chinese Academy of Sciences began 3 years ago to do research and development on use of optical disks for computers. They did a lot of technical problem solving and program demonstrations, from which they achieved quite remarkable results. But one company in Shenzhen then spent $22 million to import the same from Holland. Because of a deficiency in technical capacity and basis, they did not even know how to sign contracts. Or where the Chinese Academy of Sciences had

already done years of research on amorphous silicon solar energy batteries, where they had a conversion efficiency rate of 14 percent and more. At the same time, a factory in Harbin took up jointly funded production of the same with Japan, having a conversion efficiency rate of only 7 percent. What is more, the Chinese Academy of Sciences has already made 300 megabyte magnetic disks, while other departments have imported them.

Factors that have given rise to duplication and conflicts between imported and domestic research and development are many sided. First of all, within existing systems in this country, research and production are fragmented, and the import of technology is basically carried out in the areas of production, while the capacity for enterprise research and development is low. This is in obvious contrast with the unified systems of research and production in developed countries like the United States and Japan. Fragmentation in overall management systems has led to the separation of research planning from import planning. When information is not circulated, obstructions to information are even more a direct factor in creating various conflicts and duplications.

Naturally, we should also be aware that how we thoroughly integrate imported technology with domestic research and development is a quite complicated problem. The principles are clear, but putting them into practice is not easy. This is especially true since the current restructuring of systems in this country has not been completed. The urgent demand of the technology transformation of enterprises, the goals of good quality, high output, and low energy consumption, and especially the requirements of exporting to generate foreign exchange, may not wait for the long process whereby domestic research and development has been successful and applied to production, but instead we must directly take the path of importing technology. The key to these problems lies in our adopting various policies and measures to avoid those unnecessary conflicts and duplication. We should first of all break through the fragmentation and barriers between departments, and lateral relations and cooperation should not be strengthened just between base level research, production, and application departments. Various kinds of associations should be set up, and overall planning and management departments should enhance unified coordination and relations. The State Planning Commission, Economics Commission, Science and Technology Commission, and the Ministry of Foreign Economic Relations and Trade should join with the other ministries and formulate technology importation policies and planning on the basis of technology development policies and planning within each industry. They should also closely integrate science research planning with technology transformation and technology import planning. They should determine in which fields is technology development primarily based upon domestic autonomous research and development, in which should methods be adopted for keeping up, and in which should there be dependence upon importing technology. Then, we should give full play to the roles of scientists and technicians in the importing of technology for enterprises and in absorbing and assimilating. We should change the current phenomenon in which the process from importation through absorption is managed entirely by enterprises, while the institutes that are more experienced in research and development (including the higher institutions) are kept out of that importation and absorption and assimilation.

II. The majority of scientists and technicians cannot effectively participate in the absorption and assimilation of imported technology, which is the second manifestation of the separation of importation from domestic research and development.

One of the most serious problems existing generally is the emphasis on importation while neglecting absorption and assimilation. Because imported technology and equipment is remaining at the production level, no efforts are being made to understand the technical principles and design thinking, nor to master the technical tricks, which leads to the situation in which we are always following behind foreigners and buying their equipment. We have fallen into the vicious cycle of "import, fall behind, import again, fall behind again." Based on a recent sampling survey of 620 imported projects since 1973, not even 2 percent have been assimilated by science research units in cooperation with enterprises. The majority of enterprises have locked everything up and are handling things themselves. This, while the results are outstanding when science research units do cooperate with enterprises to absorb and assimilate.

The majority of scientists and technicians cannot make the most of their function in technology importation and its absorption and assimilation. Besides the division between science research and production organizations, there have been restrictions owing to the following factors: 1) some enterprises lack an overall and complete concept, considering imported technology as their own. They lock that technology up in fear that after science research units have joined with them, that technology will be disseminated and dispersed, by which they will lose their competitive edge. 2) The research and development of certain science research units has not yet changed to the direction of focusing on catering to the economy and catering to production. They have not yet taken the absorption and assimilation of imported technology into consideration as a major research topic. 3) In cooperating with enterprises, particular research units have been affected by the unhealthy tendency of "treating everything in terms of money." They want too high a price, and the enterprises cannot afford them. 4) There have been restrictions due to patents, as well as various regulations and policies.

To change the current situation in which the importing enterprise handles the importation and absorption and assimilation by itself, and to arouse the majority of scientists and technicians within a research unit to enthusiastically participate in the importation of technology and its absorption and assimilation, we must strengthen our work in the following areas.

First, there should be a unified understanding of the ideology, true clarification of the fact that the goal for importation of technology is not only to improve economic results, but even more is for improving our capacity for autonomous research and development. The main idea behind importation is to hasten the technical transformation of enterprises through the internal functioning of technical advances. To expend large amounts of foreign currency just to partake of foreign equipment but not absorb and assimilate it, and to not act in accordance with the ways of nationalization, is in

reality to covertly rely on the expansion of investment scales as a model for growth. Second, we should enhance the planning and coordination of each department, which will bring together the importation and science research management departments of each industry in a focussed, planned, and organized way. This will closely coordinate feasibility studies in the early stages of importation, putting the project into production, and the absorption and assimilation, and will provide economic assurances. Third, enhancing the various forms of lateral relations will combine the uses of economic levers by science research units, manufacturing sectors, and the factories and companies using the products, and will open up absorption and assimilation. Fourth, by formulating various policies and measures, science research units and enterprises making contributions to the work of absorption and assimilation can be rewarded. The results of absorption and assimilation should be seen as science research achievements, and some that fill voids should be rewarded with patent protection.

III. In our current situation of divisions between science research and production organizations, technology importation is largely concentrated in the production fields, and there is too little importation headed by research units. This is the third aspect leading to divisions between importation and domestic research and development.

Of the 550 major technology projects imported in recent years by the machinery industry, not 3 percent have been headed by institutes or higher institutions. Technology importation projects in other industries that have been headed by science research units are even fewer. There are the following advantages when science research units are in charge of technology importation, especially those industrial institutes with a basis and experience in research and development:

1. The starting point for importation is higher. Current composition of technology importation in this country is for equipment and production lines to lead the list, for the most part being 85 percent of the total. The remaining 15 percent of technology oriented imports are largely second and third line technology, while within the lifetime of all technology, equipment lags behind its corresponding manufacturing technology. For this reason, while what is imported is possibly equipment of the 1980's, within the lifetime of all world technology development, it is still in a decrepit position. This kind of obsolete old import structure has no great effect on improving capacity for autonomous development capacity and the capacity for exporting and creating foreign exchange. But to boldly bring in technology that is at its peak would require a domestic research and development base and abundant technical strength to act as reserves. Therefore, if we are to break up obsolete import structures and improve the starting point from which technology is imported, we must support qualified science research units in their importation of advanced technology that has just entered the marketplace or that is at the peak stage of research and development. Beginning from the 1960's, Japan realized that to compete with foreign products, time was an important factor, and so it successively imported many foreign technologies that were still in the testing phase, even some technologies that were still at an experimental stage, from which it was successful.

2. When imported by science research units, jointly used technology that can be broadly applied can make the most of institutes, through absorption and assimilation, and by disseminating results and transferring them to industrial sectors. This can advance the technology transformation and technical advances of entire industries, avoiding duplicate importation and saving foreign exchange.

3. Through various forms of technology importation such as joint design and cooperative production, science research units can learn from their foreign counterparts and can become familiar with advanced design thinking and methods, by which they can improve their own quality and levels of research and development.

To emphasize and enhance technology importation by science research units, we must first proceed from reality, determining the fields and scope within which science research units will undertake technology importation. Currently, technology importation projects in this country may be divided into three types.

First are various particular machines, sets of machinery, and production lines, which are called hardware or material technology. This is characterized by great expenditure of money, low risk, and ease of implementation. It can constitute production forces within a certain length of time, it belongs to the lower levels in the process of technology sales, and is considered mature within the lifetime of technology. At present, this kind of importation is largely taken on by enterprises, and science research units would be hard pressed to replace them.

Second are various kinds of mature software technologies, patented and exclusive technologies and technical secrets, including technology that is imported together with key equipment. The characteristics of this type are less expenditures of money, greater difficulty in absorption and assimilation, and also great risk. It lies in the middle level in the process of technology sales, and is at the middle of the lifetime of the technology. There are difficulties when enterprises with weaker capacities for research and development import this kind of technology. From now on, the importation of this kind of software technology and its absorption and assimilation should be considered for development by associations of science research, design, manufacturing, and production departments.

The third kind is technology currently in research and development abroad. Less money is needed for this kind than the previous two kinds, and demands on the domestic science and technology base are highest, it is the hardest to absorb and assimilate, the risks are greater, but if successful the results from putting it into production far surpass the first two. This kind of technology is at the highest stage in the sale of technology, and is quite young regarding the lifetime of the technology. Certain technology exporting countries are willing to sell this kind of technology and to jointly assume the risks. The method should be explored by which science research units are in charge of this kind of importation, and expenses might be paid by risk investment companies.

From now on, technology importation structures in this country will be comprised of the three types just described as "mature, middle-aged, and young," and by closely integrating imported and domestic science research, this will facilitate the basis and conditions for the transition to the middle and high levels of technology importation. We want now to change the methods by which technology importation is kept within production circles, to increase the proportion of imports headed by science research units, and also to determine as quickly as possible the necessary policies and measures, which will provide support and encouragement for science research units in the areas of project selection, expenses, and taxation.

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NATIONAL DEVELOPMENTS

INDUSTRIAL STRUCTURES, IMPORT POLICIES EXPLORED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENCE OF SCIENCE AND MANAGEMENT OF S&T] in Chinese No 8, Aug 86 pp 5-7

[Article by Luo Minqing [5012 3046 1987], Shanghai Radio Factory No 3, Zhu Zhaoxin [2612 5128 2450], Factory No 742, Ministry of Electronics, Ren Xiongping [0117 7160 1627], China Electronics Technology Import Export Company, Shanghai Branch, and Luo Renxiao [5012 0088 7197], Shanghai Huasheng Electric Fan Main Factory: "The Connections Between Technology Importation and Industrial Structures"]

[Text] Technology imports should be determined by two basic principles: Judgement principle for technology importation--technology importation should be based on the requirements for change in industrial structures.

Appraisal principle for the results of technology importation--the effects of technology importation should be based on whether or not it can promote the development of rationalization and intensification in industrial structures.

Importing foreign technology stimulates the development of technology and the economy in a developing country such as ours, and is a necessary and important means for hastening the pace of development. Of this, there is no doubt. However, what kind of technology can we import that will benefit the development of technology and the economy, and how should we evaluate the economic results of importing technology? This is a very important question that is well worth our exploration. Our underlying principles throughout have been to import advanced foreign technology on the basis of self-reliance, as well as to proceed in accordance with the actual situation in this country, to pay attention to comprehensive evaluations, to be well aware of selecting the best import principles, etc., all of which are certainly correct. Nevertheless, these principles have not provided people with particular qualitative and quantitative methods that are at the same time guidance in decision making or for evaluation. We believe that if appraisals are to be done correctly, technology importation ought to be determined by the following two basic principles:

1. The judgement principle for technology importation: technology importation should be based on the needs of change in industrial structures.

2. Appraisal principle for the results of technology importation--the effects of technology importation should be based on whether or not it can promote the development of rationalization and intensification in industrial structures.

In the final analysis, these two principles should resolve the connections between technology importation and industrial structures.

Well then, why is technology importation related to industrial structures?

We know that in the social reproduction process, industrial structures are the production relations and proportional relations of each material production sector of production materials and materials of daily life. These production relations and proportional relations are the results of a country's (or region's) long term technology and economic development. And they are determined by the particular country's (region's) natural conditions, such as natural resources, climate, and soil, and by the social conditions, such as standard of living and customs, political system, and economic policies. Rational industrial structures have a certain stimulating effect on the development of technology and the economy and on the improvement of a people's standard of living. If we are to take a complete look at the degrees of changes and development in a country's (region's) industrial structures, we should evaluate the "rationalization" and "intensification" of those industrial structures. What we mean by the rationalization of industrial structures is a reflection of whether or not a country or region can fully utilize and develop the natural and social resources that are its advantages to promote the high speed development of technology and the economy. This is a relative concept for each country or region that differs in time. The intensification of industrial structures is closely bound to the maintenance of a high level of economic growth rate, which reflects the improvement to a certain degree in an industry's technology and equipment structures and productivity. This is an absolute concept that throughout the world can reflect the level of technological and economic development in a country or region. At the same time, it is a relative concept that differs with time. It can be seen from this that industrial structures are a standard of development for the technology and economy of a country (or region), and a relatively comprehensive reflection of natural and social conditions. Proceeding from the demands of changes in industrial structures, we can provide technology importation with clear, concrete guidance, and from the view of the significance of industrial structures, technology importation must be connected with industrial structures. This is because technology and the economy are two necessary aspects of material production, while technology importation is an important aspect of technology activity centers. It is a necessary consequence of economic and technical development--industrial structures have become two necessary elements in material production.

These relations reflect on the one hand the determining function of industrial functions on the directions and scale of technology importation. Changes and development in industrial structures are important symptoms of economic development and changes. The demands of changes and development in industrial structures first of all exhibit the demands of economic development. We all know that the objective requirements of economic development are the fundamental source of technology development. Consequently, changes and

development in industrial structures naturally become the directions of development and change for imported technology. Then, changes and development in industrial structures show the requirements of technology development. Industrial structures are the results of the long term development of technology and the economy. Technology development depends, on the one hand, on the strength of a country and on the other hand on technology imports. In this way the strengths of many companies are used to supplement our shortcomings, and we use the technical achievements of others to hasten the improvement of our own technology. Consequently, technology importation should consider overall technology development as its direction. That is, it should take the rationalization of industrial structures and intensified development as its own directions for development. Finally, when the status quo of industrial structures limits the directions and scale of technology importation, as long as technology importation has existing industrial structures as a base, technology that is imported must be technology that existing industries can absorb and assimilate. Reliance on imported technology cannot establish a new industry. Therefore, we say that whether economically or technologically, industrial structures determine the direction and scale of technology importation, and determine that the principle of appraising technology importation is whether or not technology importation can promote the development of the rationalization and intensification of technology structures.

In another sense, these things are shown in the effects of technology importation on industrial structures. First of all, the rationality of technology importation directly affects changes and development of industrial structures. Imported technology that is closely aligned with industrial structures can rapidly constitute production forces and technology forces that achieve excellent economic results and that promote the development of production. This consequently allows industrial structures to develop rationally and intensely. Second, imported technology can promote an equal development among industrial structures, and effect a strategic shift. By placing the focus of technology importation on the sectors with weaker links in industrial structures, this will allow the technology and economy in these sectors to develop rapidly, will change those weak links in the existing industrial structures, and will suit the needs of changes in industrial structures. Finally, technology importation can promote the development of technology, improve existing levels of technology, supplement technology deficiencies, and lead to the joint development of a group of technologies. In summary, technology importation can affect the rationalization and intensification of industrial structures. The connections between technology importation and industrial structures determine that technology importation should be based on the requirements of changes in industrial structures; when evaluating the economic rationale and consequent dangers of technology importation, that must be based on whether or not the results from imported technology can promote the development of rationalization and intensification of industrial structures.

Based on dialectical thought principles that are the same in logic and in history, we make an historical investigation into the mutual relations between technology importation and industrial structures below.

Our efforts over more than 30 years of technology importation may for the most part be divided into four periods. The first period--the 1950's, the second period--the 1960's, the third period--the 1970's, and the fourth period--after 1979. Looking back on these periods of history, the determining effects of industrial structures on technology importation can be seen everywhere. As for example import principles in the first period were determined by the needs of changes in industrial structures of the time. In the erratic development of old Chinese industry, within the gross industrial output value of 1949, heavy industries constituted only about 26.4 percent, within which the machinery industry was not even 2 percent. This sort of industrial base could not realize a socialist industrialization. Consequently, the focus of imports at that time was primarily concentrated on the industrial sectors of metallurgy, machinery, and mining. Total expenses for imports at that time were equivalent to about $2.7 billion of the time, more than 90 percent of which foreign exchange was used to buy complete sets of equipment. The building up of large scale import projects at this time brought about an obvious improvement in our industrial structures. In the second period of technology imports, although there was a great change in outlook concerning our industrial structures, some of the industries concerned with the national economy and with the people's livelihood and industries for hastening industrialization and electrification in our country, as for example petroleum, chemical engineering, and precision machinery, were still rather weak. Development of these industries as rapidly as possible was an urgent requirement for technical and economic development of the time. Consequently, the focus of technology importation at this period was placed primarily in the sectors of petroleum, chemical engineering, precision machinery, and electronics. The primary means for technology importation was still centered on importing entire sets of equipment, the goals for which were to speed up changing the backward state of these industries and improving their production and technical capacities to maintain the even development of all industrial structures. But owing to natural disasters and other factors of the time, total expenditures of exchange for technology imports were only one-tenth those of the first period. And only 30 percent of those items could regularly be put to use after their importation. By the beginning of the 1970's, that is, the beginning of the third period of technology importation, the focus for technology imports was still concentrated in the aspects of industrial structures of the time that needed restructuring. Among the total expenditures of foreign exchange at this time, 51 percent was used for items to strengthen agriculture and the light industries. Synthetic fibers and plastic resins in urgent national need were developed. Later, because technology importation was not in accord with the technical and economic capacities of the time, this led to the error of an excessive scale of importation in 1978, which put an immense burden on development of the national economy. By the 1980's, technology imports returned to normal. Integrating the needs of changes in the industrial structures of the time, this changed the way by which entire outfits were imported. Focus was now on importation of single technologies, and these were joined with the potential exploiting transformations of enterprises and the upgrading and replacement of products to expand and reproduce internally. It may be seen overall that technology imports must be based on changes and developments in industrial structures, and that only by taking this as a basis can we do a good job of technology importation.

Or again, although in the 1960's the scale of our importation was not great, because we imported some key technologies in which we had been deficient, as for example oxygen overhead-blown converters, synthetic fibers, (gao hua) polyvinyls, etc., these accelerated the rationalization of industrial structures and the development of intensification, and stimulated the take-off of our steel making technologies and chemical fiber technologies. Light industries, which were one of the foci of technology importation in the 1970's, led to rapid growth in our chemical fiber production quantity, which provided contributions to resolving the clothing problems of the 1980's.

It can be seen clearly from the preceding brief historical review that industrial structures have always had a determining effect on the directions, modes, and scales of technology imports. When any change between technology importation and industrial structures is uniform, the results from technology imports will be good; when the directions are not uniform, the results from imports will be deficient. In a similar manner, the effects that occur on industrial structures after technology imports are also strong. Consequently, for technology importation in this country in the past, there has been conscious or unconscious consideration of the determining function of requirements from changes in industrial structures on technology imports, as well as the effects on industrial structures after technology importation. As for example in the total volume of technology imports over more than 30 years, where the total volume of imports for the metallurgy industry were 75 percent of total imports in all sectors, while total technology imports for the transportation and shipping industries, which have long been weak links in the national economy, have been only 0.5 percent of that total. The backwardness of the transportation and shipping industries has greatly affected the development of other industrial sectors, and industrial structures have lost the equilibrium they should have. It may be seen from this that establishing a new guiding philosophy for technology importation can not only ensure the economic and rational natures of technology importation, but can also effectively promote the development of industrial structures toward rationalization and intensification. Therefore, the judgement principle for technology importation can only be that technology importation should be based on the requirements of changes in industrial structures. The results generated from technology imported in accordance with this principle can also only be based on whether or not they will promote the development of rationalization and intensification among industrial structures.

That being so, based on these two principles, can guidance of technology importation meet the challenge of the new world industrial revolution? The answer is yes.

Viewed from our current industrial structures, there still exist certain irrational phenomena, and the distance between us and current advanced world levels is still quite great. If we proceed from the aforementioned principles, it is our belief that the focus for imports in the period that is now and hereafter should be on continuing to maintain those items that promote development of the rationalization and intensification of industrial structures.

To adjust that irrational situation of the past in which the industrial structures in this country favored the heavy industries, and to implement excellent agricultural, light industry, and heavy industry structures, we should place the focus of technology imports on strengthening some weak links in the national economy like agriculture, light and heavy industry, energy, and transportation and shipping. Where, for example, hydroelectricity and coal resources are lacking in the economically developed, technologically rich coastal regions, which has seriously affected production. In this country at present, 20-30 percent of production capacity cannot be realized because of energy deficiencies. If we develop nuclear power to change the energy resource structures in these regions, we would allow the potential in these regions to be fully realized.

To hasten the pace of development for industrial structures in this country, and to realize an intensification wherein industrial structures would approach or attain advanced world levels, we should also place the focus of technology imports on those rising new technologies that comprise the new industrial revolution, as for example microelectronics, biologic engineering, new types of materials, new energy resources, space engineering, marine engineering, etc. It is our belief that as we look at the mutual connections between the basis of industrial structures in this country and the rising new industries, we should lean toward information technologies among the rising new technologies to be targetted for import. For the most part, this means microelectronics and communications technologies, especially fiber optic technologies and development of the electronics industry.

This is because: 1) information technologies are the basis of this revolution, and when information societies that are developing rapidly depart from microelectronics technology and communications technology, then there just cannot be an information age. Also, research developments in biologic engineering and space engineering, too, cannot depart from microelectronics and communication technologies. 2) Electronics industries are vanguard industries in realizing the modernization of older industries. As for example the renovation and transformation of traditional industries like metallurgy and mining machinery and the upgrading of products, none of which can depart from microelectronics technologies. Microelectronics technologies are the necessary technologies by which older industries in this country will electrify and automate their production, and by which they will eventually have automated workshops and factories. 3) Information technologies and their computer technologies are necessary and effective tools for managing science. In modern rapidly developing social production, computers can help people solve overelaborate, complex problems, and allow modern management to be able to get into each area, each sector, and each corner of production and circulation.

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NATIONAL DEVELOPMENTS

MORE EFFORT ENCOURAGED TO GAIN FROM FOREIGN IMPORTS

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENCE OF SCIENCE AND MANAGEMENT OF S&T] in Chinese No 8, Aug 86 pp 10-12

[Article by Lu Jun [7120 6511], Office of Foreign Economic Relations and Trade, Yuyao City, Zhejiang Province: "A Brief Discussion of Keeping Effective Track of Foreign Import Items"]

[Text] After the 3d Plenary Session of the 11th CPC Central Committee, this country implemented a major open door policy. Through diligence and practice over these last few years, not only have there been many changes in the districts that have been opened up, but also many foreign import items have had a great effect on various aspects of the economy, science and technology, and society. How the science and technology sectors are to keep effective track of and serve with compensation certain advanced foreign import items at the same time that restructuring of the science and technology system deepens, is a new subject worthy of diligent study.

I. Keeping track of foreign import items is an urgent need for the science and technology sectors themselves.

Since opening up to the outside, foreign commercial interests have come to China one after the other bringing with them technology from all over the world, economic information, partial funding, advanced equipment and technology, a partial international market, and rather more effective management methods. Therefore, these things cannot help but affect and challenge production in the science and technology sectors, primarily in the following areas:

1. The advantages of foreign imported hard technology.

Because of continued development over long periods, industry in developed countries has a better industrial base, with better hard technology such as equipment, raw and supplementary materials, inspection methods, and instrumentation. They have certain advantages to differing degrees whether in performance or quality, or in stability or reliability. If these hard technologies continue to surge forth, they will bring great pressure upon our science research units.

2. The advantages of imported foreign soft technology.

Because foreign enterprises have long been in competitive situations, this has forced them to keep improving in both technology and technique. Therefore, regarding exclusive technologies and soft technologies, they have long been ahead. If these soft technologies continue to come in, the effect on research units in this country will be quite apparent.

3. Competitive capability regarding foreign import pricing.

Developed countries have gone through a stage of capitalist industrialization, where improvements in technology standards have been rapid. They have gradually developed from manual methods to semi-mechanized, mechanized, and completely automated ones, from small quantity production to production in large quantities, from the individual and collective to socialized large production, and from empirical management to scientific management. Therefore, their rate of application has been high, their costs are lower, and they are quite strongly competitive in pricing.

4. The challenge of imported items on the pace of science research.

Currently, the great majority of science research project goals in this country are all based on foreign standards of the early 1980's. According to general science research regulations, any science research needs a certain period for science research and this must be a certain period in front of actual production, for only in this way can the original science research goals be realized, or can there be use value. Consequently, because some foreign items themselves are at international levels of the early 1980's, after they are imported, they may be rapidly applied for a short time. In this way they will be prominent as science research units take over domestic applications fields and technology markets, which will result in a passive situation in which science research units cannot keep up with the pace of science research, and which in turn will bring a strong challenge to the pace of science research.

Therefore, these new problems generated by imported items must be looked at closely by science and technology sectors, which must actively seek appropriate policies. Otherwise, this will not only determine the possibilities for science research goals, but for some fields of application there is the danger of being completely supplanted. There is therefore the urgent need for science and technology sectors themselves that attention be paid as soon as possible to keeping up with imported items.

II. Keeping up with imported items is an urgent need for production sectors.

Because it has not been long that we have been open to the outside, the work of importation is yet another new task to be explored, one in which we lack experience, and consequently one that causes enterprises some difficulties in the processes of selecting, discussing, and implementing import items. This is especially so in the area of technology, where resultant trouble and problems are even more numerous, and where keeping up will be primarily reflected in the following areas:

1. Because for our enterprises, and especially the small to medium ones, scientific and technical information is not up to date, there will be many cases where we suffer losses in pricing.

2. In technology importation, it is not easy to coordinate key components, raw and supplementary materials, exclusive technologies, inspection methods, component fittings, and back-up technologies, which delays the process of nationalization.

3. Because of deficiencies in our enterprise technology, this has led to some out-moded, obsolete equipment and technology that has caused our products to lose their ability to make their own way.

4. Technology personnel in our enterprises are deficient in foreign language abilities, and in discussions often fall into passivity, which has led to many legal provisions that are not to our advantage.

What we have just discussed illustrates the importance of enhancing our enterprise technology capacities and improving the levels of technology for the enterprises themselves. Therefore, regarding keeping up with what is imported from abroad, many enterprises ardently hope that science and technology sectors and science research units can provide them with powerful support and assistance, which would also create excellent opportunities and conditions for providing compensated technical servicing by which science and technology sectors would keep up with imported items. In the process of keeping up, it would allow science and technology sectors to both serve enterprises and also be able to attain the dual goals of an improvement in the levels of technology for science research units themselves, while gaining a certain quantity of economic results.

III. The path and methods for keeping effective track of imported items and for compensated service thereof.

For a long period, competition for science and technology sectors and science research units has been exclusively carried out within science research and science and technology management. Therefore, there are some advantages in the areas of technology, management, and policy, and as long as there is coordination, they are likely to play a strong role in the processes of keeping up with imported items and of compensated service thereof, and results are likely to be outstanding. In particular, the following prospects and methods apply to science and technology sectors in regard to keeping effective track of imported items and in regard to compensated service thereof:

1. With planning for developments in science and technology as a guide, help production sectors formulate hierarchical import item planning.

Technology selection is the most important link among the many in the work of foreign importation. Not only must the technology of the imported product itself be considered, but so also should a whole series of technologies connected with this product; not only should the degree of advancement and the applicability of the technology be considered, but how economic it is should

also be taken into consideration. Therefore, it may be said that technology selection itself is the key to foreign importation. When in the past we had the situation of a too varied and duplicative production of household appliances, the chief reason for that was that we lacked a single foreign import plan that was comprehensive, hierarchical, and all encompassing to be the guide for scientific and technical developmental planning, to be the core of national economic development planning, and to be the direction for industrial development planning. In addition to this, there was insufficient overall guidance that was effectively coordinated or quantitative, which caused some unnecessary setbacks for enterprises. If the past is not forgotten it can be the guide for the future, and if science and technology sectors can on their own accord join production sectors together for exploration, demonstration, analysis, and the working up of mid, long range, and short term foreign import planning, then not only will science and technology sectors understand beforehand the motivation of production sectors for foreign importation, thus avoiding unnecessary conflicts among foreign import items, but this will also allow production sectors and enterprises to share outlooks and clarify directions, avoiding blindness and the creation of losses.

2. Exploit the existing data and information resources of science and technology sectors, and be the technical advisers to production sectors and to enterprises.

Regarding the categories of technology, science and technology sectors still have certain advantages over production sectors, whether it is in the quality or quantity of technical materials possessed, the breadth or depth of knowledge, or the pace of transfer or feedback for technology information. This is because aside from having larger scale information research organizations and books and materials libraries, they can also broadly collect all kinds of science and technology information through various technical means and channels of technology exchanges to form their own databases. If the science and technology sectors can fully make the most of and utilize these valuable information resources, they can serve as excellent technology consultants and advisers for production sectors and enterprises. They can provide compensated technical service so that the science and technology sectors will not only benefit in themselves, but production departments can also gain time and results as quickly as possible.

3. Use the abundant technical capacity of the science and technology sector to hasten the pace at which enterprises absorb, assimilate, update, and innovate.

Particular foreign commercial interests have invariably left a series of technological gaps in foreign import items, on the one hand seeking to use our inexpensively priced labor and land, and on the other to occupy for a long time our internal markets and control the capacity of our goods to sell abroad. This has created a passive situation in which we have long relied upon them. In facing up to this kind of situation, because of limitations in the science research methods and experimental conditions of enterprises, their technical capacities and vigor, when it has come to increasing the pace of absorption and assimilation there has been a clear excess of zeal and lack of

strength. If science and technology sectors could rely on their own technical capabilities, if among import items they could promote cooperative models that are Chinese (enterprises), Chinese (science and technology), and foreign, and if they relied on the principle that they would use that in which they are naturally strongest, then they would look at sample machinery and sample products imported by enterprises to gradually undertake a series of reverse engineering studies wherein they dissect, map out, laboratory test, and analyze some key technology problems omitted by the foreign interest. Not only will this greatly hasten the pace at which enterprises absorb, assimilate, update, and innovate, will it hasten the process of nationalization, allowing enterprises to escape the control of foreign interests, but will also allow the level of science and technology in the science and technology sectors themselves to be improved, which in one great leap will truly attain the goal of using what is foreign for Chinese use.

4. Through systematic analysis, guidance of management methods will quicken the implementation of foreign imports by enterprises.

Be it large or small, the management work for any foreign imported item will be far more complex and difficult than for a similar domestic item. Aside from what is in common between similar items, there are also certain characteristics. For example:

a. Item procedures: selection --> purpose --> category --> feasibility studies --> contracts and regulations --> industrial and commercial registration --> implementation --> go into production --> conclude.

b. Sectors that are involved: Bank of China --> customs --> product inspection --> import/export company --> foreign shipment --> management of foreign exchange.

c. Relevant policies: foreign affairs --> foreign economics --> foreign trade --> foreign exchange --> laws --> labor management --> land management.

d. Technology and techniques: compatibility between imported portions and self made portions --> overlapping --> combination --> forming a set.

Regarding the rather complex item system described above, if enterprises can be made to understand this, they can effectively use systems engineering to analyze it. Through various systematic dissections, combinations, statistics, and coordinations, they can greatly hasten the pace at which enterprises make use of foreign imports, and can gain the best economic results as early as possible.

5. Assist in the appraisal of the quality of imported foreign equipment and products, which will allow enterprises to better handle the final technology examination and acceptance.

To undertake a complete process regarding imported items, in international practice the payment of monies for importing equipment and technology is divisible into stages, the last portion only being paid when the buyer has settled into production and the products are completely in accordance with

previously ascertained technical qualities and quotas. Therefore, the final technical appraisal of imported equipment, technology, techniques, and products will prove decisive. If at this critical stage, science and technology sectors can diligently assist enterprises in full scale, scientific, accurate technical appraisals of relevant portions of imported items, then not only will enterprises be less affected by economic losses, but the science and technology sectors themselves will have accumulated some valuable technical materials, which will create even better conditions for their own applications and development of new products.

6. Try to provide foreign language services to assist enterprises in absorbing imported technical materials.

From the point of view of an overall analysis, at present imported items are largely small or medium size items and the enterprises in charge of said importation are small to medium sized enterprises. For this reason, the technical capacities of enterprises have been rather weak and there has been a distinct lack of talent in foreign languages. Therefore, many difficulties have been encountered in contacts with foreign written technical materials and in discussions. If science and technology sectors could develop the advantages of their own foreign language expertise, on their own accord providing enterprises with compensated services, then not only could they improve their own foreign language proficiency, but they could also satisfy the pressing needs of enterprises.

IV. The function of effective tracking of import items and of compensated service, and the results of all this.

Several years of actual practice have shown that in the areas of promoting the renewal of existing enterprise products, advancing the performance of existing enterprise products, improving enterprise product quality and economic results, improving the levels of enterprise operational management, and increasing the capacity of enterprises to generate foreign exchange, foreign imported items have a definite function. But there are still some problems that cannot be avoided, as for example having little that is of the advanced level of the early 1980's, few key gap-closing products, few foreign sales, little complete nationalization, etc. As we proceed to improve our opening to the outside and our investment conditions, regarding the completion of economic regulations for dealing with foreign interests and the accumulation of experience with foreign economic and technical contacts, the entire effort for importing will be in transition from the original exploratory steps to higher level stages, during which the following development trends are sure to appear:

production models

development trends

--> develop from processing of incoming materials and compensation trade to jointly funded, cooperative operations

--> develop from small and medium items to major sets of items

--> develop from sole importation of hardware such as equipment to the comprehensive importation of technology and software concurrently

--> develop from short term, small scale cooperation to long term, large scale cooperation

--> develop from partial reliance on foreign interests to complete nationalization

--> develop from a majority of domestic sales for a product to a large portion of foreign sales

--> develop from low grade technology that is imitative and decorative to updated, innovative high quality technology

In summary, because of the tracking and intervention of science and technology sectors, there will be a great hastening of the process in which we import and by which technology is modernized. This will reduce the gap between us and the levels of technology of developed countries.

The open-door policy is one of our basic national policies, and importation from abroad is a new effort in this new age. As long as science and technology sectors are closely bound with production sectors, as long as there is effective coordination, keeping track in common, efforts at exploration, an opening up of forward progress, going with one's strengths, supplementing of deficiencies, a banding together for strength, and a public spirit, then a new situation for importation from abroad that is alive and vital will appear before our very eyes.

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FOREIGN EXCHANGE EARNING ACTIVITIES DESCRIBED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENCE OF SCIENCE AND MANAGEMENT OF S&T] in Chinese No 8, Aug 86 pp 13-14

[Article by Qiu Jinquan [0092 6855 3123], Shanghai Science of Science, and Gu Wenxing [7357 2429 5281], Shanghai Science and Technology Commission: "Science and Technology and Generation of Foreign Exchange Through Exports"]

[Text] In implementing the open-door policy, in strengthening economic trade abroad and technology exchanges, in extending use of foreign investment and the importation of advanced technology, the key lies in increasing exports to create greater foreign exchange. This is an important strategic policy by which to quicken the process of our socialist modernization, and it should be included among major topics in our study of science and our studies of science and technology policies.

Improvement of the quality of any product, an increase of its quantity, a development of its variety, a change in its structure--all these things are closely bound up with science and technology. None of them can be apart from the application of new materials, new technologies, new techniques, and new equipment. When these high technology products appear in markets, they are even more the results of developments in rising new technologies. For these reasons, we may say that international trade competition is at bottom competition between technologies. Advances in science and technology are a determining factor in regard to the generation of foreign exchange by exports.

There are differences in the degree of development in the economies, science and technology, and societies of different countries and regions. They depend upon developments in science and technology for export trade, and the ways and methods for increasing foreign exchange income, too, may each be similarly distinguished. Looking at those areas they share and in which they are successful, and joining these with the actual situation domestically, there are at least the following ways in which to develop generation of foreign exchange by science and technology:

1. Transform traditional products, use the results from science and technology to develop new products, improve the degree of processing of raw materials, change the functions of products, restructure packaging, and renew the face of traditional products that have been the same for decades. This will increase the capacity for competitive sales abroad, which will greatly improve the rate at which foreign exchange is generated. If we were to

process the rabbit fur we currently export into rabbit fur garments, the export currency generation value of a unit weight of rabbit fur would triple.

2. Develop the achievements of rising new technologies, establishing rising new industrial sectors. Develop commercial export products that are technology intensive, and fundamentally change the structures of export products. For the coastal cities of Shanghai, Tianjin, and Dalian, this sort of expansive prospect is not so far off. Naturally, each city and region has its own characteristics. Shanghai has given precedence to the development of microelectronics, new materials, and biologic engineering, from which they have begun to see products, as for example the research achievement in microbiology where new bacteria souring methods produce citric acid, where more than 30 citric acid plants throughout the country have established long term technology cooperation relations, allowing production of citric acid throughout the country in recent years to grow at a rate of 50 percent. In addition to satisfying internal markets, there is also an annual export of more than 20,000 tons, which generates foreign exchange of $25 million.

3. In developing technology trade, we should not only import the technology of other people, but should also export our own technology, developing a bidirectional technology trade. In the first half of this year, research units and plants and factories affiliated with the Ministry of Aviation Industries exhibited in New York their own technologies and products for sale. In just a few short days, the volume of transactions was several tens of million dollars.

4. Organize the absorption, assimilation, and innovation for imported technology and equipment, seeking for return sales in international markets. The Zhengtai Rubber Plant absorbed and assimilated the belted tubeless technology of the West German (mizile) Tire Company and had set up a domestic operation, it developed by itself a group of new techniques with rubber compounds, which improved tire casing design, gave a focus to plant spirits, realized a "Zhengtai-fication" of production techniques, and created the "Huili" brand belted tire, which allowed the tires that we formerly produced and which were not able to be used on international freeways to be renewed. After inspection by the ECE, the highest monitoring body of international tire quality, the Huili brand belted tire was certified to be first rate. This tire is currently being sold abroad in 58 countries and regions, including some in Europe and the Americas.

5. Seek to replace imports to save on the expenditure of foreign exchange. Each year, the Shanghai Office of Goods and Materials imports about 1 million tons of metal materials alone, at a cost of $200 million in foreign exchange. The amounts of foreign exchange needed by other systems to import components and equipment is even greater. The potential for "national production replacing imports" can easily be seen. Based on the calculations of the three offices of textiles, handicrafts, and light industry, these three offices have already transplanted 132 kinds of equipment, saving foreign exchange in the amount of $145 million by replacing the equivalent imported products.

6. Develop "trade, industry, and research" associations. This is a particular construct of "industrial and trade integration, and technology and

trade integration," and is also an important attempt to reform the abuses resulting from foreign trade, production, and science and technology all going their own ways. This kind of association that takes foreign trade as its center, a particular product for export in exchange for foreign exchange as its goal, and is composed of foreign trade departments, production units, and science research units joined through contracts or agreements, jointly develops a particular export product or particular type of export product.

7. Use technical superiorities to develop transnational companies. Many of the characteristic traditional techniques and technologies in this country, as well as new technical achievements, can be sent abroad for jointly funded development with the creation of transnational companies.

To allow the realization of ideas by which science and technology will generate foreign exchange, we should have corresponding policies and measures.

1. Establish funds for science and technology to create foreign exchange and funds for high technology risk investment. Support the development of some scientific and technical achievements that can be expected to generate foreign exchange in the near future, and reward research and production units and individuals who have been most effective in using science and technology to generate foreign exchange.

2. Loans by the People's Bank for export products to generate foreign exchange should give preference in terms of interest and duration of loan. Local banks should establish foreign exchange loans to provide factories and science research units with the necessary materials for import, which should wait until the product has been exported before repaying what has become foreign exchange. A proportion of foreign exchange loans approved should be used for generating foreign exchange through science and technology.

3. Foreign exchange markets should be gradually opened up, as should marketplaces for foreign exchange generation materials. Permit nationally owned or collective units having foreign exchange from appropriate sources to undertake trade in foreign exchange and trade in production materials to regulate the foreign exchange turnover for production and science and technology units that have export products, which will improve the effects of using foreign exchange.

4. Directly allocate assistance for foreign business losses to production units, science research units, or associations that have export products or technology. This will encourage production and science research sectors to use it in improving product quality, will promote product renewal, will keep up expansion of exports, and will lower the costs of converting exchange.

5. Formulate necessary laws and regulations to encourage and protect Chinese-foreign joint investments and cooperation. Draw up special policies that establish and get involved in transnational companies to promote the development of activities in these areas.

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NATIONAL DEVELOPMENTS

EXAMPLE OF IMPORTED S&T BENEFITS DESCRIBED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENCE OF SCIENCE AND MANAGEMENT OF S&T] in Chinese No 8, Aug 86 p 14

[Article by Bian Zhenjia [6708 2182 3946], Institute of Pharmacy, Chinese Academy of Medical Sciences: "Viewing the Function of Institutes in Technology Importation As Seen From the Development of Centrifugal Thin-Layer Tomographic Instrumentation"]

[Text] Centrifugal thin-layer technology is a new technology that has developed in recent years that rapidly separates organic compounds. It can improve the results of separations, can hasten the speed of separations, and is a revolution in tomography technology. In 1980 the Institute of Pharmacy of the Chinese Academy of Medical Sciences imported a Model 7924 Chromototron from the United States, which after use was considered to be a new means for convenient, effective, and economical separation of organic compounds. It was understood from a survey that this had not been broadly applied domestically, and that many industries and units could make use of this instrument to expand their research. We immediately set out to make one in cooperation with the Qingyun Instrument Plant in Beijing. In all we used more than one-half year's time to successfully develop the LFZ-1 Centrifugal Thin-Layer Tomographic Instrument. In April 1981, an overall technical appraisal organized by the three machinery ministries unanimously considered this instrument to be suitable for application in medicine, petroleum engineering, and dyeing research in this country. Moreover, separation results for certain compounds exceeded those of the American instrument, which filled a void in the development of separation instrumentation for organic chemical constituents in this country.

In the area of disseminating applications for this instrument, this institute has joined with the factories to hold study classes throughout the country. As the specialists of the institute have explained the principles, use, and maintenance of the instrument, it has been disseminated to 452 units in 28 provinces throughout the country. High output has spread throughout the country, and has been welcomed by users. From after the appraisal session until the end of 1984, 1,252 units were manufactured for a gross output value of 4.75 million yuan. Within a short period of time, rather high economic and social results were obtained, and at present there are still many units that have placed orders. This development work was evaluated by the Ministry of

Public Health as a first class achievement, and received as well a third prize among national science and technology advances. Relevant sectors of the nation consider that this has become a model example of the absorption and assimilation of imported technology.

From the successful development of the LFZ-1 centrifugal thin-layer tomographic instrument, we feel that in the close cooperation between institutes and factories there are many advantages:

1. Institutes tend to better understand the advanced technology of the industry in question and may import with fewer difficulties, avoiding unnecessary losses for the country.

2. While importing technology, institutes can act as back-up for factories, taking full technical responsibility, taking charge of product quality, and bringing about the production of qualified products.

3. In the area of disseminating applications, scientists and technicians can hold study classes for scholastic publicity and to help users train operations and maintenance personnel.

4. This allows imported technology to be able to be rapidly absorbed, assimilated, and transformed into production forces, which serves our national economic construction.

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PROVINCIAL EFFORTS TO ENHANCE S&T IMPORTATION URGED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENCE OF SCIENCE AND MANAGEMENT OF S&T] in Chinese No 8, Aug 86 p 15

[Article by Liang Zhaochun [2733 0340 2504], Heilongjiang Institute of Machinery: "Some Suggestions Regarding the Importation of Foreign Technology by this Province"]

[Text] From 1979 through May 1985, through the multiple channels of national and local foreign exchange reserves and bank loans, Heilongjiang Province has cumulatively transacted 506 import projects through the various forms of compensation trade, importation of equipment, purchase of manufacturing certification, and leasing, for a total transaction volume of $681 million. Up to the present, throughout the province there have been 907 enterprise (facility) units that have imported advanced equipment and relevant technology in 15 professions from 27 countries and regions (Hong Kong and Taiwan). Over the last few years, there has been an item imported on the average of every 4.5 days, with an average transaction value for the imported item of $1.345 million. In this context, I mention the strategic thinking for future technology importation and some suggestions.

The Strategic Thinking Behind Technology Importation

1. Between the present and the future, the future will be more important. To blindly keep our attention on the equipment importation that is right before us, and to lack a long term comprehensive plan and thinking, these are common failings existing in our current technology importation efforts. In this province, we should turn from satisfying our current needs to giving full weight to long term needs, we should make use of advanced foreign technology to promote the development of domestic science and technology as the guiding ideology for managing technology importation in this province, and we should take the path of "import--absorb and assimilate--innovate and disseminate."

2. Between hardware and software, software should be preeminent. Facts of development both within this country and abroad have proven that the software that is the certification for imported technology, techniques, and patent rights can better promote the development of domestic manufacturing technology and techniques than hardware like imported equipment and instrumentation. And it can reduce the development times for coming up with new technologies.

Looking from the long term, this is even more worthwhile economically than directly importing equipment, and it can avoid reliance on foreign technology. According to current conditions in this province, in future technology importation we should choose to import both software and hardware, developing gradually toward a preference for software importation. In no way can we handle everything all in the same way, which would cause imbalances in our importation efforts.

3. Between absorption and assimilation on the one hand and innovation on the other, preference should be given to innovation. This then requires this province to progressively effect three changes in our modes of importation: a change from satisfying production requirements to engaging in new research; a change from focusing on importing equipment to a focus on the importation of soft technology; a change from varied importation to more single-minded importation. In this way, this province will gradually constitute a system for the importation of technology that suits the characteristics of the conditions of this province, and which will strongly promote technological progress in industries in this province.

4. Importation and science research should progress hand in hand. Technology importation efforts should progress in step with domestic science research efforts. Corresponding science research systems should be established, advantageous strengths should be concentrated, and imported items should be studied, absorbed, and disseminated. As for example to better use the local natural resources in this province, we should gradually develop cooperation with foreign science research to study a new generation of products for the international marketplace.

Some Suggestions Regarding Technology Importation Efforts

1. Establish specialty organizations for technology importation, and enhance leadership. I suggest the establishment of a provincial technology importation office, first of all to understand the relations from all aspects, to accept full responsibility for the efforts at technology importation, absorption and assimilation, and innovation and dissemination in this province, to reduce the separation between efforts at importing technology and at assimilation and dissemination, and to maintain continuity and synchronization between importing and science research, and between importing and absorption and assimilation. The organizations could be independent or be set up within the provincial planning and economics commissions or the science and technology commission.

2. Draw up comprehensive plans for technology importation and for assimilation and dissemination. The provincial government should be in charge, and relevant departments of the provincial science and technology commission should be in charge of organizing the scientists and technicians in the industries of machinery, light industry, and electronics to investigate each profession in this province, and to draw up development plans for technology importation in this province. In planning, technology importation and science research should progress equally and the importation of technology and its assimilation and dissemination should continue, but it should also be

linked to technology transformation plans in this province to form a comprehensive plan for technology importation.

3. Break up usual conventions, and import through associations of science research, manufacturing, and application sectors. We should break up the practice by which only the applying enterprise undertakes the importation. For import items that are large in volume or broad in application, that are valuable for dissemination, and that will affect the national economy, the provincial government should take charge of joint coordination with relevant departments of the provincial science and technology commission and the planning and economics commissions, with the participation of the three areas of science research, manufacturing, and application departments. From the feasibility analyses in the early stages of importing an item to the assimilation, manufacturing, and dissemination, all three areas should be involved from beginning to end to ensure that the imported item can be absorbed and innovated upon, and that it can be broadly disseminated. As far as importation expenses are concerned, these should be resolved by all three areas jointly.

4. Draw up rules and regulations, and enhance the legal management of importation efforts. It has been reflected throughout the foreign business world that when China deals with the outside it is still the case that policy replaces laws and regulations, that contracts replace laws and regulations, and that consultation replaces laws and regulations. This shows that the central and local laws and regulations in this country regarding technology importation are not yet complete. We should base ourselves upon the situation in this province and upon relevant central laws and regulations, and should formulate laws and regulations that suit the "technology importation laws" for specific conditions in this province. This will legally ensure the progress of technology importation and of efforts at its assimilation and innovation in this province.

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CULTURAL FACTORS IN TECHNOLOGY TRANSFERS STUDIED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [STUDY OF SCIENCE AND MANAGEMENT OF S&T] in Chinese No 8, Aug 86 pp 16-18

[Article from the Youth Forum on Science by Ke Yinbin [2688 6892 2430], (23 years old): "On the Function of Cultural Factors in Technology Shifts"]

[Text] There are many factors that might lead to the failure of a technology shift. People have paid most attention to the factors of technology, management, and talent, while the effects of cultural factors on the technology shift have not received their due attention. This is because, first of all, the functions of cultural factors are certainly not direct, but are generated after passing through "intermediate" links; second, the important functions of cultural factors are certainly not obvious in the early stages of the technology shift, and are only fully apparent at higher levels within a technology shift that has progressed far; finally, the functions of cultural factors are complex. For this reason, we must undertake a comprehensive study before we can explore the functions of cultural factors within technology shifts.

I. The Concept of Technology Shifts

There are many definitions of technology shift. Some scholars proceed from the angle of the applying technology units and propose that "technology shifts are the processes through which the knowledge of one location is applied at another"; some people have focused on technology itself, considering that "technology shifts are where existing technology is applied in fields never before so applied"; some people also feel that technical knowledge gained through technical information is also within the sphere of technology shifts; some stress that technology shifts have a goal and are organized, so that self-accuating diffusion of technology is not considered part of this; some have broadened the significance in pointing out that "technology shifts bring scientific and technical knowledge out from research groups and from scientific and technical documents, putting it into the hands of users"; (Footnote 1) some then proceed from the three factors of people, machinery and equipment, and information and data in technology shifts, considering that technology shifts are "shifts in these three factors, that is, shifts in the technical status formed by the combination of these three factors"; (Footnote 2) and others believe that "technology shifts are the processes by which a

certain technology (including the condition of invention) is applied at locations different from its origin or its actual field"; (Footnote 3) the definition in "The Dictionary of Science" is that "technology shifts are primarily commercial, where both the inventor and importer of a technology gain the greatest advantages, and are processes through which technology exporting countries shift modern technical information, expertise, and technical experience to technology importing countries." (Footnote 4)

From every differing viewpoint, the definitions above show some essential meanings to technology shifts. This provides a basis and foundation to our study. I believe that a scientific study of technology transfers should not be limited to the process of transfer, that it should not only study the process of circulation for technology commodities, but should also study the production and reproduction processes for technology commodities; it should not be limited to the field of technology, but should place technology shift activities within social systems for observation, to study the mutual effects and functions between them and the social-cultural environment; it should not be limited to an overall study, but should subject technology shift activities to factorial and space-time hierarchical decomposition, to which should be added analytical research to obtain more profound conclusions. Looking at it this way, the subject matter of technology shift studies is extremely bountiful. In this regard, we will select only one-- the function of cultural factors in technology shifts-- for our study.

II. The Three Level Structure Existing in States of Technology and Culture

There are three different levels existing in both technology and culture, and this objective fact is the primary basis proposed for the three level model of the function of cultural factors in technology shifts.

Regarding existing states in technology, this may be explained from two angles, one being that of the structure of technology, the other the organizing catalysts of technology.

Looking at the situation from the view of technology structure, there are the following three states present in technology (Footnote 5): the macroscopic level, by which is meant the general technology system of a country at a given time; the intermediate level, by which is meant the technology group centered around a particular technology, composed of this technology and ones related to it; the microscopic level, by which is meant a single technical achievement, that is, a technical unit. It is obvious that there are very close connections existing between these three levels. The intermediate level is a group of technical units gathered together to achieve a particular purpose, while the macroscopic level is composed of technology groups of differing structures and differing functions.

From the point of view of the organizing catalysts for technologies, there are also generally three levels existing in the states of technologies: the technology system at the national level, the technology system at the enterprise level, and the technical personnel at the individual level.

There are also two ways of understanding the three levels in the states of culture. One is an understanding through a cultural concept, and the other is an understanding from the angle of the cultural catalysts.

There are three different levels in states of culture from the point of view of understanding through the cultural concept: the broad level, by which is meant the sum total of material and spiritual riches created in the actual process of mankind's social history, where culture and civilization would have the same meaning; the middle level, which aside from "religion, science, and culture," also includes all culture that is manifest in the material and spiritual lives of people and in man's societal relations; the narrow level, by which is meant the cultural undertakings of education, science, literature, art, news publishing, broadcast television, hygiene and physical education, libraries, and museums. (Footnote 6)

There are the following three levels existing in culture from the point of view of cultural catalysts: the culture of a nationality, the culture of an enterprises (or a social division level), and the cultural person that is an individual. We can also understand the culture of each level in terms of the concept of the three levels, which consequently constitutes a cultural network structure made up of cultural concepts and cultural catalysts as the coordinate axis. Due to the subject matter under study and the goals thereof, this paper selects a diagonal line element within that structure as its target of discussion.

III. A Three Layer Model of the Functions of Cultural Factors in Technology Shifts

As described thusfar, it is not difficult to discover that the three level structure existing in states of technology and culture may be linked together through the auspices of the three level structure of each of the organizing catalysts acting as an intermediate link. Consequently, the function of cultural factors in technology shifts is a rather complex problem.

The functions of cultural factors in technology shift activities studied in this paper only include: the function of the broad-based nationality cultural factor on technology shifts as seen from the macroscopic angle, the effect of the intermediate social division cultural factor on technology shifts as seen from the intermediate level, and the effect of the individual cultural quality on technology shifts as seen from the microscopic level.

1. The macroscopic level of the effects of cultural factors on technology shifts.

In this regard, our understanding of the macroscopic levels of technology takes a broad concept of culture as its object. Therefore, technology is an important "intermediary" in the relations between man and nature, it acts as a dynamic relation for man toward nature, and it is an important component of all of mankind's culture. If we were to analyze in terms of systems theories, culture would be a complex large system, while technology would be an important subsystem within the large system, and in this way, the function of culture on technology would mean the effect of the cultural large system on

the technology subsystem. This kind of function would also have a different significance for differing scopes of functions. If the function scope is within a particular country, then the function of culture on technology indicates the nationality characteristic of a technology, that is, in the process of development of a technology, the difference between nationalities caused by differences in language and regional environments, economic life, and culture, or, the characteristics of the technology and technology systems of a nationality that differ from other nationalities (Footnote 7); if the functional scope exceeds national boundaries, that is, when there is a technology shift activity between two countries, the effect of culture on technology appears as the nationality of the technology, namely, it has the technology system of the particular nationality characteristics, and in the assimilation and absorption of technical achievements of other nationality characteristics brought in from outside, it will be the process of the amalgamation of the organic components of this technology system or of the constitution of a new system. (Footnote 8) In this regard, the effects of the one country's culture on the technology of the other country would appear in the merged relations between the technology that has already been nationalized on the one hand and the technology of the other country. This latter case is what we have called the macroscopic level of the effects of cultural factors on technology shifts. Studies of the functions of this level and of their legality are an important basis by which a country researches and formulates technology development and import strategies.

2. The intermediate level of the effects of cultural factors on technology shifts.

To this end, we have an intermediate level understanding of technology, where by culture is meant the culture of a social division in the intermediate sense. Regarding the functions of this level, we can explain them through the different modes of technology shifts. There are two kinds of modes for technology shifts: the first is considered as the guiding factor in technology shifts, and includes the technology promotion mode and the market force mode; the second is analyzed from the functions played by all aspects in technology shifts, and includes the technology provider/technology receiver mode and the alternating mode. Within these two modes, the contents and manners of the functions of cultural factors are not the same. In the technology promotion mode, the curiosity of the researchers and the sense of value gained are the driving forces for research, while some counter cultural phenomena, like superstition and religious doctrine, are obstacles to research. The imperfections of the science and technology system in the broad sense of cultural systems will also block the smooth progress of the technology shift process. In the market force mode, many items within the realm of the middle level of culture, as for example the needs of eating and drinking culture, clothing and decoration culture, building culture, and entertainment and music culture are all reflected in market commodities, while technology creation and direction and substance in importation for technology researchers and importers are resolved by analytical research of market needs. In this way, cultural factors function in the process of technology shifts through this link of market needs. In the technology provider/technology receiver mode, because the technology of both sides has not only the characteristics of nationalities, but is also an entity resulting from the merging of these with

particular social division cultures, both parties not only have differences in technologies, but also have differences in culture. Therefore, when the receiver of technology is selecting technology, it should not only pay attention to the capacity of the provided technology to be assimilated, but should also pay attention to whether or not the cultural factors brought over by the provider's technology can be merged with the social division culture of the receiving party. Regarding study of the functions at this level and their legality, this is an important factor that must be considered when an enterprise is selecting the directions, types, and levels of imported technology.

III. The microscopic level of the effects of cultural factors on technology shifts.

The functions at this level are manifest in the individual human. Any particular technology shift activity is also completed with the participation of humans, but what people pay more attention to are the functions of the participants as technicians, while ignoring their functions as cultural entities. In fact, this latter condition has a very important effect on the success of a technology shift or on its yield. For example, for technology to be the tools and means for conquering nature requires that individuals have the confidence that they can overcome nature; the goal of technology shifts is to improve the rates of applicability, which demands that individuals have strong concepts regarding the rates of applicability; the characteristics of technology are innovation and development, which demands that individuals not follow old ways. Therefore, regarding studies of the functions of this level and their legality, those who are selected to directly participate in technology shift activities on behalf of enterprise units have provided principled guidance.

12586
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PHYSICAL SCIENCES

CRUSTAL STRUCTURE, UPPER MANTLE IN SOUTH CHINA SEA

Beijing NANHAI HAIYANG KEXUE JIKAN [NANHAI STUDIA MARINA SINICA] in Chinese
No 4, May 83 pp 1-9

[Article by Lin Jinfeng [2651 6651 1496], South China Sea Institute of Oceanology, Chinese Academy of Sciences: "Features of Crustal Structure and Upper Mantle in Central Part of South China Sea Inferred from Gravity Anomalies"]

[Text] English Abstract: The depty of the Moho discontinuity beneath the central basin of the South China Sea is about 10 km, which is shallower than that of the adjacent ocean and marginal seas. At the same time, the Bouguer anomaly of the basin is about 320 mgal, lower than that of adjacent and marginal seas. It is evident in contrast with the ordinary condition, that is, the shallower the Moho discontinuity, the higher the Bouguer anomaly.

According to available seismic profiles, the calculated residual-gravity anomaly in the central basin of the South China Sea is about (-110 mgal, showing that such a high minus residual-gravity anomaly probably resulted from the no inhomogeneity of the upper mantle. Besides, it is estimated that the thickness of the lithosphere beneath the central basin of the South China Sea is about 37 km, as compared with the free-air anomaly, and it is evident that the isostatic compensation in this basin is in close relation with the uplift of the asthenosphere.

The South China Sea is a large marginal sea in the Pacific Ocean. It is situated between the Pacific Ocean Plate, the Australian-Indian Ocean Plate, and the Eurasian Plate and has a complex geological structure. Studying the geological structure of the South China Sea and its mantle characteristics has definite significance for exploring the crustal evolution of the Pacific Ocean's marginal seas.

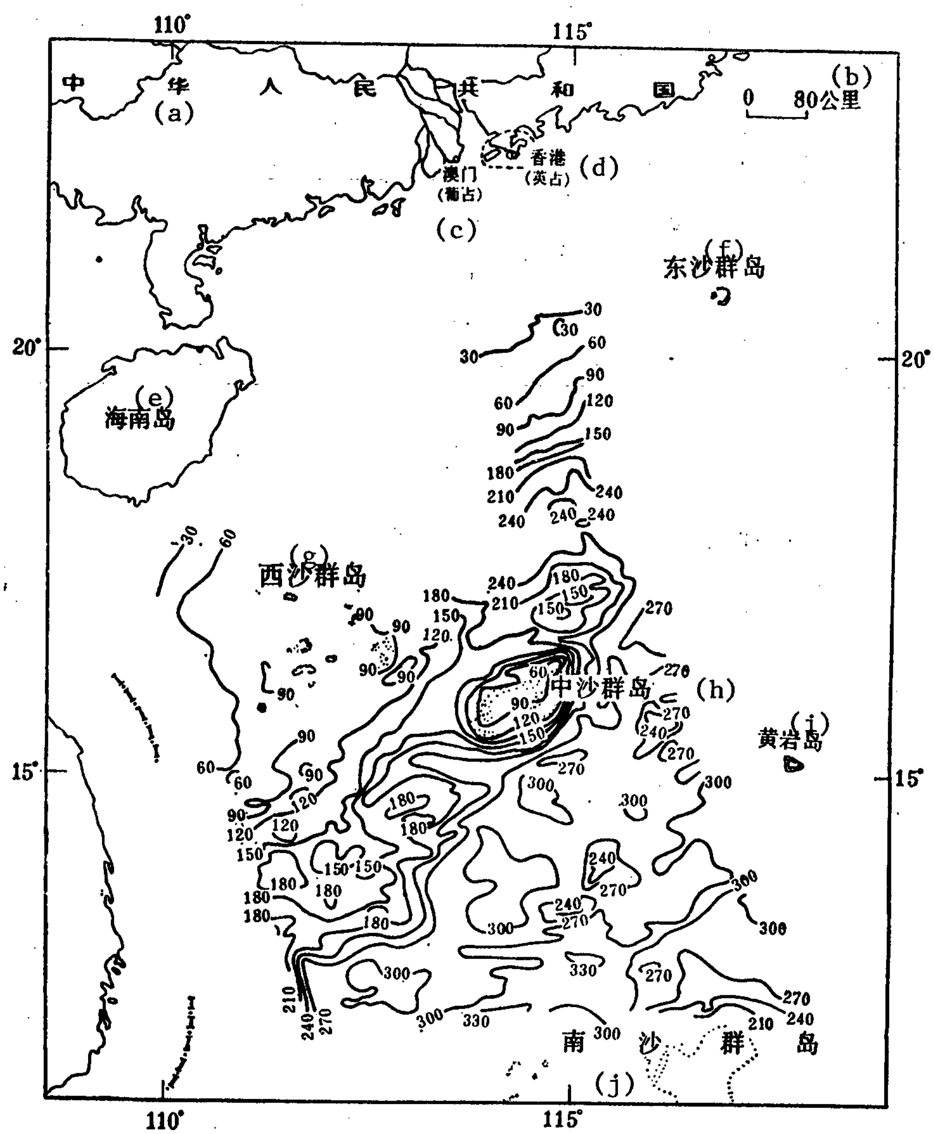
In recent years, our institute's R/V Haiyan has carried out measurements in the South China Sea area north of 12° north latitude uring a Chinese-manufactured marine gravity meter and has obtained nearly 4,000 km of gravity data. The precision of these measurements is ± 10 mgal. Calculated anomalies were calculated according to the 1901-09 Helmert's normal-field formula. The anomalies obtained through calculations according to the 1930 international normal-field formula for this area were about 18 mgal lower. When the gravity data published by the other writers cited in this paper on the basis of the 1930

international normal-field formula, the anomalies were all recalculated according to the 1901-09 Helmert normal-field formula. The intermediate precision used by the Bouguer correction was 2.67 g/cm^3, and the seawater density was 1.03 g/cm^3. This paper is an analysis based on research on the crustal structure of the central South China Sea and its mantle characteristics on the basis of gravity anomalies.

I. Bouguer Anomaly Characteristics in the Measured Area

The Bouguer anomalies in Figure 1 indicate that 1) characteristics of regional Bouguer anomalies correspond to changes in the nature of the crust and 2) deep faults which are indicated by gravitational step zones and the controlling role which they play in changes in the nature of the crust.

Figure 1. Map of Bouguer Anomalies in the Central and Northern Parts of the South China Sea



Key:

a. People's Republic of China

b. Kilometers

c. Macau (Portuguese occupied)

d. Hong Kong (British occupied)

e. Hainan Island

f. Dongsha Archipelago

g. Xisha Archipelago

h. Zongsha Archipelago

i. Huangyan Dao

j. Nansha Archipelago

The Bouguer anomalies in the measurement area increase from -10 mgal in the continental shelf in the north to +320 mgal in the central ocean basin in the south. The continental shelf in the northern and western part of the South China Sea is continental crust, and the Bouguer anomalies increase from -10 mgal to +50 mgal. From the continental slope to the northern edge of the central marine basin is transitional crust, and the anomalies increase from +50 mgal to +200 mgal. From the continental step in the western part of the edge of the central marine basin in the eastern part is transitional crust and the anomalies increase from +40 mgal to +200 mgal. The central marine basin is oceanic crust, and the anomalies are approximately +200 to +320 mgal. The Xisha archipelago and the Zhongsha archipelago are continental crust, and the anomalies are approximately +50 mgal to +80 mgal.

There are the following six clear gravitational-anomaly step zones in the measured area and their characteristics are given in Table 1.

II. Characteristics of the Crustal Structure of the Central and Northern Parts of the South China Sea

On the basis of the gravitational measurements obtained in the South China Sea we drew a Bouguer anomaly map, and consulting the papers published by people earlier, we tried to use gravitational anomalies to explore the crustal structure of the central part of the South China Sea. However, due to the fact that there are a variety of possible explanations under one condition and the errors contained in the correction of the observation results, we had to combine other materials with the gravitational data before we could obtain reliable results on crustal structure and thickness. Ludwig (1979) and Dash (1970) carried out seismic refraction measures in the South China Sea and drew some maps of crustal structure cross-sections and using the actual depth of the Moho discontinuity obtained by seismic refraction as a standard. This made it possible for us to use the gravitational data to calculate in reverse the depth of the Moho discontinuity in the measurement area so that we could obtain a more complete map of the crust structure in the South China Sea.

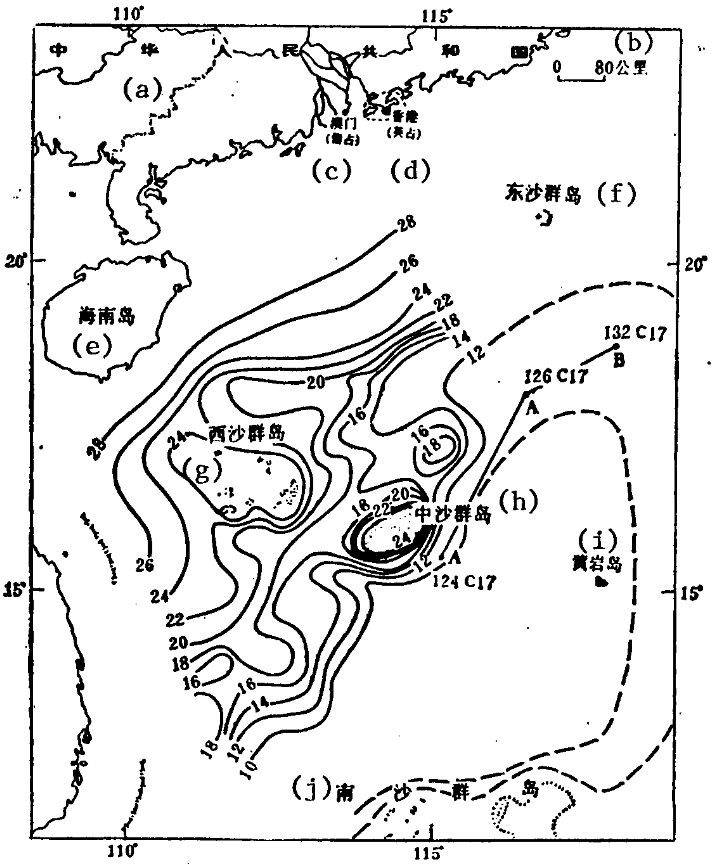
The Moho discontinuity depty map (Figure 2) drawn in this paper was calculated using the Tsuboi (1957)[2,3] method of calculating the Moho depth on the basis of Bouguer anomalies. In the center of the sea's basin, the results of calculation and seismic refraction fit.

On the basis of the Moho discontinuity depth map (Figure 2) which we drew and in combination with the gravity anomaly characteristics and the topographic geomorphology characteristics, we can divide the crust in the central and northern parts of the South China Sea into three types and four regions (Figure 3): 1) the continental shelf of the northern part of the South China Sea (including Beibuwan) is continental crust and the depth of the Moho discontinuity is 27-31 km; 2) the area from the continental slope of the northern part of the South China Sea to the northern edge of the central basin of the South China Sea is transitional crust and the depth of the Moho discontinuity is 12-27 km; 3) the central basin of the South China Sea is oceanic crust and the depth of the Moho discontinuity is 10-12 km; and 4) the Xisha islands and the Zhongsha Islands are continental crust and the depth of the Moho discontinuity is 23-27 km.

Table 1. Characteristics of Gravitational Step Zones in the Measured Area

Gravitational Step Zone	Bouguer Anomaly (mgal)	Horizontal Step (mgal/km)	Characteristics
Northern continental slope of South China Sea	+20 - +50	1	This zone marks a continental slope fault in the northern part of the South China Sea. The fault is the boundary between the continental slope crust and the transitional crust.
Northern edge of the central oceanic basin of the South China Sea	+110 - +200	3	This zone marks a fault on the northern edge of the central oceanic basin of the South China Sea. The central and eastern parts are the boundary between the transitional crust and the oceanic crust.
Eastern Xisha	+90 - +150	3.5	This zone is a reflection of the fault east of Xisha and exhibits a northeast direction.
Western Xisha	+80 - +170	4.5	This zone is a reflection of the fault west of Xisha and also exhibits a northeast direction.
Central Xisha	+100 - +260	8	It is a reflection of the eastern part of the Xisha, exhibiting a northeast direction, the central section is the boundary between continental crust and oceanic crust, and the northeast and southwest sections are the boundary between transitional crust and oceanic crust.
Western Xisha		Very small	Primarily exhibits northwest expression and may be a reflection of the extension of the Hong He fault. It is not as clear as other step zones in the measured area.

Figure 2. Map of Moho Discontinuity Depth in the Central and Northern Part of the South China Sea



Key:

a. People's Republic of China

b. Kilometers

c. Macau (Portuguese occupied)

d. Hong Kong (British occupied)

e. Hainan Island

f. Dongshai Islands

g. Xisha Islands

h. Zhongsha Islands

i. Huangyan Dao

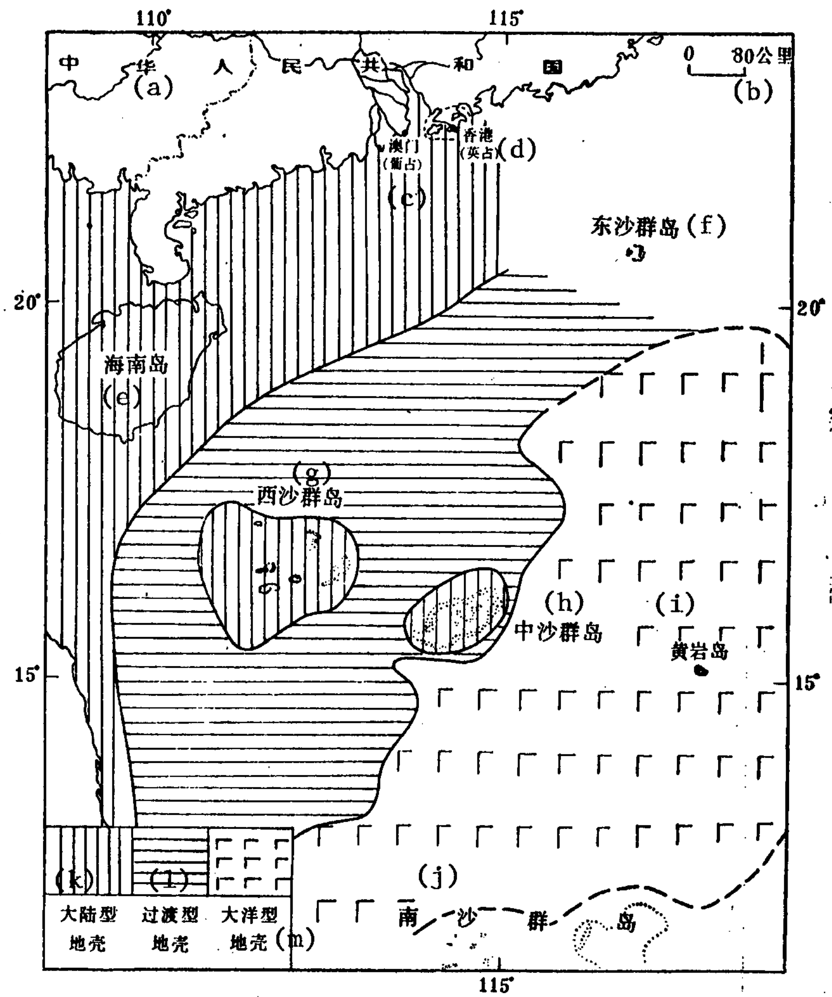
j. Nansha Islands

The characteristics of the crust in the central and northern parts of the South China Sea are as follows:

1. There Is a Clear Corresponding Relationship Between the Moho Discontinuity Depth and the Age of the Fold

From Figure 2 it can be seen that the depth of the Moho discontinuity in the central and northern parts of the South China Sea becomes gradually thinner from north to south and from west to east. The age of the folds gradually becomes younger from north to south and from west to east. The eastern part of Beihaiwan is Caledonian folding zone and the depth of the Moho discontinuity is 31 km. The continental shelf in the northern part of the South China Sea (from the mouth of the Zhujiang to the southeast side of Hainan Island) is Hercynian folding zone and the depth of the Moho discontinuity is 27-30 km. From the continental slope of the northern part of the northern edge of the central basin of the South China Sea is Yanshan folding zone and the depth of the Moho discontinuity is 12-27 km. The central basin of the South China Sea is an extension fracture of the Xishan period, and the depth of the Moho discontinuity is 10-12 km. A comparison of the age of the fold and the depth of the Moho discontinuity of the continental shelf, where the water depth of the South China Sea is 0-50 meters, can make clear whether or not the depth of the

Figure 3. Diagram of Crust Structure Types Divided by Region in the Northern and Central Parts of the South China Sea



Key:

a. People's Republic of China

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c. Macau (Portuguese occupied)

d. Hong Kong (British occupied)

e. Hainan Island

f. Dongsha Islands

g. Xisha Islands

h. Zongsha Islands

i. Huangyan Dao

j. Nansha Islands

k. Continental type crust

l. Transitional type crust

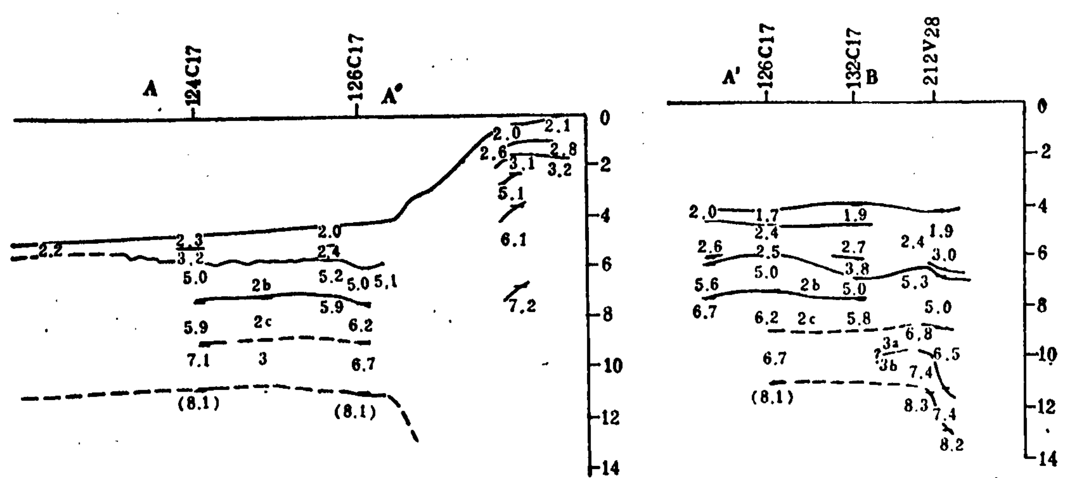
m. Oceanic Crust

Moho discontinuity is related to water depth. From the continental shelf Beihaiwan, from outside the mouth of the Zhujiang to the southeast face of Sunda in the southern part of the South China Sea, the water depth is 0-50 meters and in these three areas the depth of the Moho discontinuity is not the same and the ages of the folds are also not the same. Beihaiwan is a Caledonian folding zone with a Moho discontinuity depth of 31 km, and the continental shelf from outside the Zhujiang to the southeast face of Hainan Isalnd is a Hercynian folding zone with a Moho discontinuity depth of 27-30 meters, as has already been described above. Here, the Sunda continental shelf should be pointed out in particular, and although we have not made gravity measurements but based on the seismic materials of Dash published by Ben-Abraham and K.O. Emery (1973)*, the depth of the Moho discontinuity of the Sunda continental shelf is 20 km, and it belongs to the Indo-Sinian folding belt and is clearly different from the two previous areas.

2. The Oceanic Crust Structure of the Central Basin of the South China Sea Is Stratum Thick and $Stratum_3$ Thin

The cross-section A-A' illustrated in Figure 4 shows $stratum_2$ divided into two strata, i.e., $stratum_{2B}$ and $stratum_{2C}$, with wave velocities of 5.0-5.2 km/sec and 5.9/6.2 km/sec, respectively. The $stratum_3$ wave velocity is 6.7-7.1 km/sec. Along this cross-section, the overall thickness of $stratum_2$ is 1 km thicker than the normal thickness, while $stratum_3$ is nearly one-half the normal thickness. Cross-section A'-B also presents a similar situation. $Stratum_2$ is about 1 km thicker than the normal thickness, while $stratum_3$ is about 2 km thinner than the normal thickness.

Figure 4. Cross-section of Crust Section Drawn from Air Gun-sonar Data (According to Ludwig, 1979. For AA' and A'B, see Figure 2.



3. The Depth of the Moho Discontinuity in the Central Basin of the South China Sea Is Relatively Shallow

The results of gravity data calculations and the seismic refraction measurements obtained by Ludwig (1979)[7] both show that the depth of the Moho discontinuity in the central basin of the South China Sea is about 10 km. This is clearly shallower than the depth of the Moho discontinuity in the neighboring Western Sulawei Sea (13 km), Sulu Sea (11-12 km), Philippine Sea (12 km), Western Pacific (12 km), and Indian Ocean (13 km, south of Java). A Moho discontinuity depth this shallow in the central basin of the South China Sea is very characteristic of the marginal seas in the Western Pacific.

III. Upper-mantle Characteristics of the South China Sea

The wave velocity of the upper mantle in the central basin of the South China Sea is 8.1 km/sec. If 8.0-8.2 km/sec is viewed as the normal wave velocity in a normal upper mantle, then there is no significant difference between the upper-mantle wave velocity of the central basin of the South China Sea and the wave velocity of a normal upper mantle and it is very close to the Western

Pacific's upper-mantle wave velocity of 8.15-8.2 km/sec. Then what are the characteristics of the upper mantle in the central basin of the South China Sea?

To answer this question, it would be useful to compare it with the Western Pacific and its neighboring seas. The statistical data is presented in Table 2.

Everyone knows that the Bouguer anomaly can directly reflect changes in the depth of the Moho discontinuity. That means that the shallower the depth of the Moho discontinuity, the greater the Bouguer anomaly. This is because there are clear density differences in the upper mantle and the crust. The depth of the Moho discontinuity in the central basin of the South China Sea is 10 km, 2-3 km shallower than the depth of the Moho discontinuity in the Western Pacific and the neighboring seas mentioned above. Thus, for the above reasons, the Bouguer anomaly of the central basin of the South China Sea should be larger than that of the Western Pacific and the neighboring seas mentioned above. Yet, the situation is the reverse; the Bouguer anomaly of the central basin of the South China Sea is smaller than these areas, especially compared to the Western Pacific, for the anomaly is roughly 80-100 mgal smaller.

Table 2. Comparison of Central Basin of the South China Sea With Data from Neighboring Oceans and Seas.

Region	Water Depth (km)	Moho Discontinuity Depty (km)	Upper-mantle Wave Velocity (km/sec)	Bouguer Anomaly (mgal)	Heat Flow (HFU)
Central basin, S. China Sea	4.2	10	8.1	320	2.7
Sulu Sea	4.5	12	8.27	380	2.4
W. Sulawei Sea	5.2	13	8.02	400	1.5
W. Pacific	5.6	12.4	8.2	400	1.3
Philippine Sea	5.5	12	8.37	430	1.5
Indian Ocean	5.0	13	8.1	400	

It is generally accepted that the depth of the Moho discontinuity becomes shallower as the water depth increases, and since the water depth in the central basin of the South China Sea is shallower than the water depth in the Western Pacific and the neighboring seas mentioned above, the depth of the Moho discontinuity of the former should be deeper than the depth of the Moho discontinuity of the latter, but the actual situation is just the opposite: the depth of the Moho discontinuity of the central basin of the South China Sea is smaller. Kinsman [1975] made some statistics according to Airy's isostatic hypothesis and believes that if a 30-km thick continental crust obtained isostatic compensation when originally placed near sea level, then as the depth of the seawater increased it would gradually become thinner. Their relationship is as follows:*

Overlying Water Depth (km)	Crust Thickness (km)
0	30
1.1	25
2.2	20
3.2	15
4.3	10
5.4	5

According to the above relationship, the crust thickness of the central basin of the South China Sea should be 10 km. However, its actual thickness is only 6 km, which is a significant deviation from the crust thickness required during isostatic compensation, and because of this thinning of the crust the excess mass created on the mantle as a result should put this region in an extremely unbalanced state. Yet, the free free-air anomaly of the central basin of the South China Sea is not large, and in general can be viewed as already having been isostatically compensated.

From this it can be seen that the above-mentioned phenomena of the central basin of the South China Sea are a contradiction to the general rules. It is very difficult to explain these phenomena from the characteristics of other crust structures. If we can deduce that the thickness of the lithosphere in the central basin of the South China Sea is smaller than the thickness of the lithosphere of the Western Pacific, and assume that the density of the low-velocity stratum of the upper mantle should be lower than the density of the high-velocity stratum below the Moho discontinuity, then a rational explanation of these phenomena can be given.

Kanamori and Press (1970), Kanamori (1968), and Abe and Kanamori (1970)[6] have found the thickness of the lithosphere on the basis of research on earthquake surface waves and shear velocity. The results of their studies show that the average thickness of the lithosphere of the Western Pacific is 75 km, and that in the marginal seas, such as the Sea of Japan where the thickness of the lithosphere is about 35 km, should be thinner than the average thickness of the lithosphere of the Western Pacific.

Concerning the problem of density anomalies of the upper mantle, Birch (1969) and Ringwood (1969) deducted the relationship of density and seismic wave velocity under high temeprature and high pressure. When studying the upper mantle in the regions surrounding Japan, Yoshii (1972)[4,5] pointed out that the seismic-wave velocity of low-velocity strata is about 6 percent smaller than the seismic velocity of high-velocity strata, and if the low-velocity strata is only caused by high temperature, then the 6 percent wave velocity difference can produce a density difference of less than 0.07 g/cm^3; if the low-velocity strata are only brought about by partial rock fusion, then the 6 percent difference in wave velocity is equivalent to 10 percent partial rock fusion and can cause the density to drop probably 0.05 g/cm^3.

On the basis of the above results, we can use the known crust structure model to estimate the gravity anomalies caused by non-uniformity of the upper mantle and, on the other hand, can also estimate the thickness of the lithosphere.

To estimate the gravity anomalies in the central basin of the South China Sea brought about by non-uniformities in the upper mantle, we selected the crust structure and upper mantle of the Western Pacific as the standard structure (see Fibure 5b below). The thickness of the representative lithosphere of this standard structure is 75 km, and the free-air anomaly is zero. The parameters from the sea surface to the strata of the upper mantle are as follows:

Water depth = 5.6 km, density = 1.03 g/cm^3;

Deposition layer = 0.4 km, density = 2.2 g/cm^3;

$Stratum_2$ = 1.2 km, density = 2.6 g/cm^3;

$Stratum_3$ = 5.2 km, density = 2.9 g/cm^3;

Depth of Moho discontinuity = 2.4 km;

Density of upper mantle = 3.3 g/cm^3.

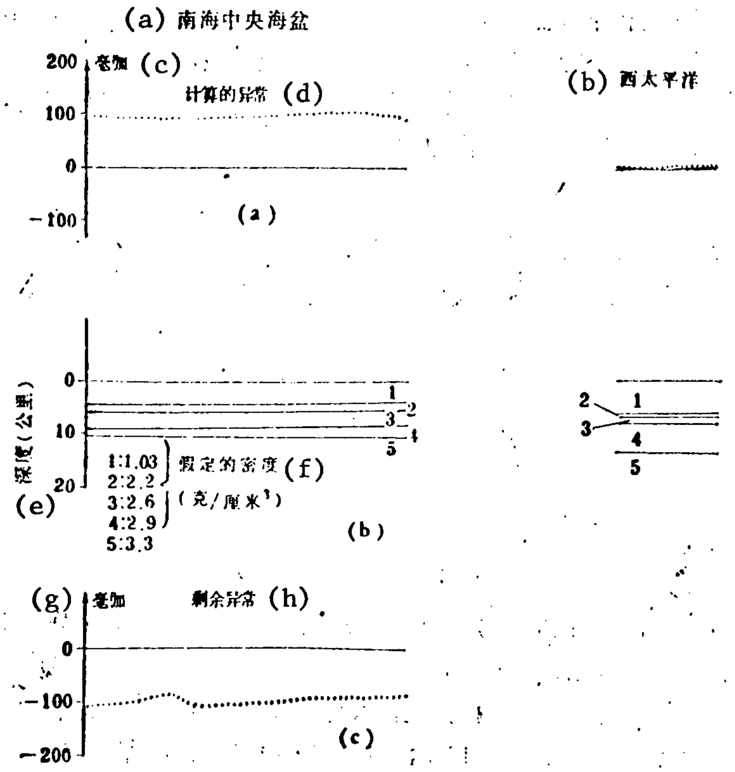
The crust structure cross-section of the central basin of the South China Sea in Figure 5b uses the models obtained by Ludwig from seismic refraction. The density values used in the calculations are also marked in the figure.

When the gravity anomaly values obtained through calculations in Figure 5 are compared with the free-air anomaly values obtained through observation, we discover that the calculated values and the observation values are not uniform. The calculated anomaly values are 100 mgal greater than the observed free-air anomaly values. The residual-gravity anomaly value of subtracting the calculated anomaly values from the observed free-air anomaly values is about -110 mgal. Such a large negative anomaly shows that it is caused by the non-uniformity of the upper mantle. On the basis of the residual-gravity anomaly obtained, we used the difference in density between the high-velocity stratum and the low-velocity stratum (0.07 g/cm^3) to estimate that the low-velocity stratum of the central basin of the South China Sea is 38 km higher than the low-velocity stratum of the Western Pacific. That is, the lithosphere of the central basin of the South China Sea is 38 km thinner than the lithosphere of the Western Pacific: the actual thickness is 37 km. And this is an outstanding characteristic of the upper mantle of the South China Sea. This characteristic not only can explain the fact that the water depth of the central basin of the South China Sea is not deep, which is why the depth of the Moho discontinuity is shallow, the Bouguer anomaly and the free-air anomaly are smaller, and the heat flow is higher, but also indicates that a balanced adjustment function can occur in the crust and also can occur in the low-velocity stratum of the upper mantle. Thus, the excess mass created by the shallow depth of the Moho discontinuity of the central basin of the South China Sea can block the rise of the low-velocity stratum.

Figure 5. Cross-section of Residual Gravity Anomaly in the Central Basin of the South China Sea:
(a) Calculated Anomaly Cross-section;
(b) Crust Structure Cross-section;
(c) Residual Anomaly Cross-section

Key:

a. Central basin of the South China Sea
b. Western Pacific
c. Mgal
d. Calculated anomaly
e. Depth (km)
f. Hypothetical density (g/cm^3)
g. Mgal
h. Residual anomaly



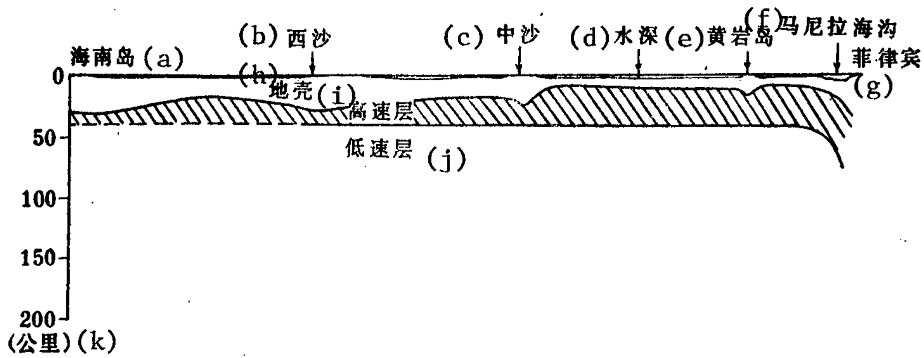
IV. Discussion

In summary, we have the conditions for proposing a South China Sea crust-upper mantle model (Figure 6). From Figure 6 it can be seen that the crust of the central basin of the South China Sea is thin and the thickness of the high-velocity stratum is small, with a corresponding relationship of the following geophysical characteristics: the stratum above the low-velocity stratum is shallow, the free-air anomaly in the basin is small, and the heat flow is high. These corresponding relationships are not accidental but are the result of crust and upper-mantle long-term evolution reflected in the process of forming the South China Sea.

B. Gutenberg (1959)[1] felt that the "statics" part of the crust balance was differentiated by the thickness of the crust rock stratum, especially produced by the thickness of the Conrad discontinuity and the Moho discontinuity, and its "dynamic" part was primarily the effect of fluid processes in the upper part of the mantle. On the basis of the above we propose a South China Sea crust-upper mantle model and have reason to believe that the compensatory function of the central basin of the South China Sea comes from the deep part, at first because the mass residual created the depth of the Moho discontinuity in the basin is shallow and because the low velocity layer which is less dense than the high-velocity layer rises and the balancing adjustment obtained by the relative reduction in the thickness of the lithosphere, thus arriving at a

balanced state in the central basin of the South China Sea. At present the free space anomalies measured in the central basin are small and few earthquakes occur, which means that it has already achieved isosatic compensation. This indicates that the South China Sea is a "static marginal sea basin which high heat flow" [Karig, 1971][4].

Figure 6. Model of South China Sea Crust-Upper Mantle



Key:

a. South China Sea
b. Xisha
c. Zhongsha
d. Water depth
e. Huangyan Island
f. Manila Channel
g. Philippines
h. Crust
i. High-velocity stratum
j. Low-velocity stratum
k. Kilometers

(Paper received on 4 August 1980)

FOOTNOTES

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CSO: 4008/1065

PHYSICAL SCIENCES

AUTOMATIC TELEMETERING OCEAN DATA BUOY SYSTEM

Beijing NANHAI HAIYANG KEXUE JIKAN [NANHAI STUDIA MARINA SINICA] in Chinese
No 4, May 83 pp 157-174

[Article by the New Technics Laboratory, South China Sea Institute of Oceanology, Chinese Academy of Sciences: "'South China Sea Buoy No 1': An Automatic Telemetering Ocean Data Buoy System; Research and development on this project were carried out by the South China Sea Institute of Oceanology of the Chinese Academy of Sciences, the Institute of Automation of the Chinese Academy of Sciences, and the Institute of Oceanology of the Chinese Academy of Sciences and completed with the cooperation of the Henan Hebi Radio Plant No 1, the Guangzhou China Shipbuilding Plant, the Shanghai Changning Battery Plant, and the Institute of Oceanographic Instruments of the State Shipbuilding Bureau"; first paragraph is source supplied abstract]

[Text] Abstract: The buoy "South China Sea Buoy No 1" was launched on 26 October 1979 in the region located at 19° 28' 34.5" N 110° 52' 17.5" E with a water depth of 25.5 meters outside Qinglan Harbor, Wenchang County, Hainan Island. It has experienced three strong typhoons in nearly a year and some data in situ have been gained. This automatic telemetering buoy system consists of a buoy, the "South China Sea Buoy No 1," at sea and a shore station in Guangzhou. Thirteen oceanographic meteorological parameters and 7 warning signals are measured and transmitted 8 times or 24 times a day. Every set of data is transmitted four times on the 6-2 MHz and 8-MHz bands alternately. Operation programs can be changed automatically from the normal 8 times a day to 24 times a day as the wind scale exceeds 8, or manually by remote-control command from the shore station. Also, the tape recorder in the buoy can be put into operation so that data can be stored as well as transmitted simultaneously and the crystal clock in the buoy can be checked and corrected by remote-control commands. The radar reflector and signaling light in the buoy can be detected within an effective range of about 4 km.

Using an automated marine buoy system, fixed-point, real-time marine data for a number of parameters can be obtained relatively economically and continuously on land and can corroborate and supplement data obtained over a wide area by marine research vessels and remote sensing techniques. If linked to a meteorological station, through central data processing it can have broad applications in meteorological and marine forecasting and monitoring. The Data Buoy Office (NDBO)[2] of the U.S. National Oceanographic and Atmospheric Administration (NOAA) and the Japan Meteorological Agency (JMA)[3] had obtained good results by setting up buoy networks nationwide.

A great deal of research and testing was done on buoy technology in many countries during the sixties and by the seventies the field had gradually matured. Currently buoys have entered the stage of production and application of standard models.[4-9] In recent years, due to the application of integrated circuits and satellite communication technology, automated marine observation buoys have been developing in the areas of miniaturization, commercialization, networking, and nationalization.

On 26 November 1979 "South China Seas Buoy No 1" was placed at 110° 52' 17.5" E 19° 28' 34.5" N, that is, outside Qinglan Harbor, Wenchang County, Hainan Island, at a water depth of 25.5 meters. In a year of testing, it proved that it could automatically measure, transmit, and record a variety of marine parameters. The test results are reported below.

I. Overview of the "South China Seas Buoy No 1" Automatic Telemetering System

The buoy system is made up of the "South China Seas Buoy No 1" at sea and a shore station set up on land at Guangzhou. The entire system was manufactured from Chinese-produced elements, components, and materials.

The buoy can operate with two programs:

Program 1: Once every 3 hours, i.e., 8 times a day;

Program 2: Once every hour, i.e., 24 times a day.

Each time the 6-MHz and 8-MHz frequencies are used twice alternately to transmit the same group of data, that is, four times. Under normal circumstances, Program 1 is in operation. If winds of a force exceeding 8 are encountered, it automatically switches to Program 2 to collect more data. As needed, manual operation can replace the program by remote command from the shore station and the tape recorder on the buoy can be started so that the data are stored at the same time it is sent. In addition, the clock on the buoy can be corrected through commands. The buoy has a radar reflector and a beacon so that ships within a range of 4 km can spot it and not collide with it.

Currently, the transmitter measures 12 hydrological and meteorological parameters (see Table 1) and reports 7 warnings (see Table 2). There are 10 remote commands (not all of these are used as yet).

II. Buoy and Its Anchoring System

The buoy itself is a disc-shaped steel structure with a diameter of 6 meters, and a height of 1.4 meters. With a platform height of 3.8 meters, and an 8-meter tall antenna tower on the platform, the buoy's overall height is 13.2 meters, its weight is 12.8 tons (not including the mooring system), its draft is 0.72 meters, its displacement is 15.5 tons, its height of the center of gravity is 0.5 meters, and it is attached to a single-point 8.6-ton length-type reinforced-concrete fixed-point mooring set on the bottom by a 31-mm cast steel shielded mooring chain. The bottom of the sunken part is U-shaped to increase drag (drag is estimated at over 6 tons). At the same time every 4 meters, one shield in the shielded mooring chain is cut out to make deployment and recovery easier.[10]

Table 1. Remote Sensing Parameters

No.	Item	Rang	Precision	Transmitter Output	Notes
1	Autocheck	100001		Autocheck Frequency	
2	Wind direction	16 bearings	±1 bearing	Frequency	
3	Buoy position	16 bearings	±1 bearing	Frequency	
4	Salinity (0/00)	28-35	±0.1	Frequency	
5	Water Temp. (°C)	0-35	±0.2	Frequency	
6	Air temp. (°C)	-10 - 440	±0.5	Frequency	
7	Av. wave ht (meters)	0-10	0.5 meters over 5 meters	Frequency	
8	Av. wave period (sec.)	2-20	±1	Frequency	
9	Instantaneous anchor pull	0-30	±5 percent	Frequency	
10	Flow direction	0-360°	±10°	Frequency	
11	Flow velocity (m/sec)	0.03-2.5	2 percent mean diff.	Pulse code 8.4.2.1	
12	Instantaneous Max. wind vel. (m/sec)	50 max.		Pulse Code 8.4.2.1	
13	Av. wind vel. (m/sec)	2-50	±(1+5 percent real measurement	Pulse code 8.4.2.1	

Table 2. Remote Warning System

Sequence	Item	Signal prompt	Output voltage
1	Instrument cabin leaking water	Leakage depth 1 cm	8-10 V high level
2	Buoyancy chamber leaking water	Leakage depth 1 cm	8-10 V high level
3	Clock control +12 V voltage drop	+12 V drop of 10 percent	8-10 V high level
4	Transmitter last +24 V voltage drop	+24 V drop of 10 percent	8-10 V high level
5	Instrument cabin door open	Cabin door opened	8-10 V high level
6	Beacon out	All four beacon lamps damaged or bulb changer obstructed	8-10 V high level
7	Instrument cabin temperature too high	Temperature exceeds 45°C	8-10 V high level

Table 3. Calculations of Dynamic Stability

Transverse pitch θ	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
Arm of force L (m)	0	0.65	1.04	1.12	1.09	0.99	0.84	0.66	0.46	0.25
Integral axis σ	0	0.65	2.34	4.50	6.71	8.79	10.62	12.12	13.24	13.95
Ld=0.08736	0	6.06	0.20	0.39	0.59	0.77	0.93	1.06	1.16	1.22

The buoy's wind resistance is 60 m/sec, and can take a maximum wave height of 12.8 meters without capsizing. Simulation tests were carried out in the wind-wave pool of the Shandong Oceanographic College's Dynamics Test Laboratory, and when the wind velocity reached 60 m/sec, the drag on the upper end of the anchor chain was 17 tons, while the drag on the lower end was 5.7 tons. The buoy's wave-following performance was excellent, swing was not great, and in scale 2 seas, operations on the buoy continued normally. It was towed at 5 knots in scale 4 seas without burying the bow or spinning. The stability conforms to the demands of the ship stability regulations. See Figures 1-4 for the buoy structure. See Figure 5[10] and Table 3 for simulation stability curves.

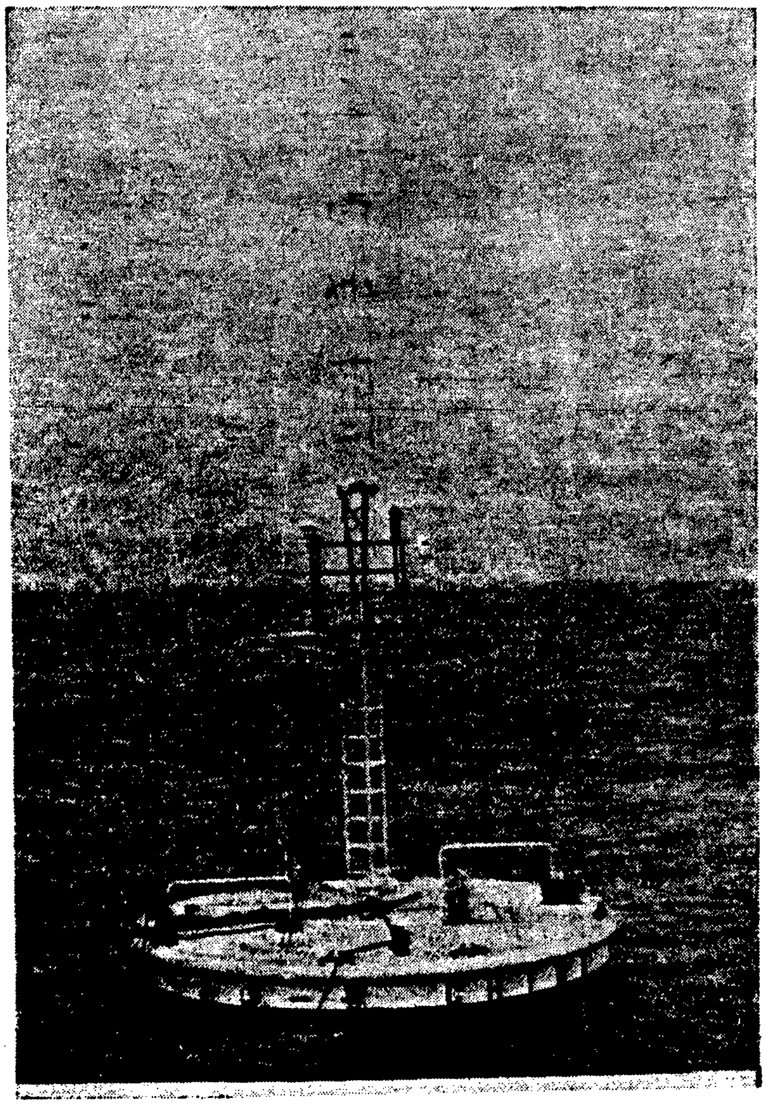
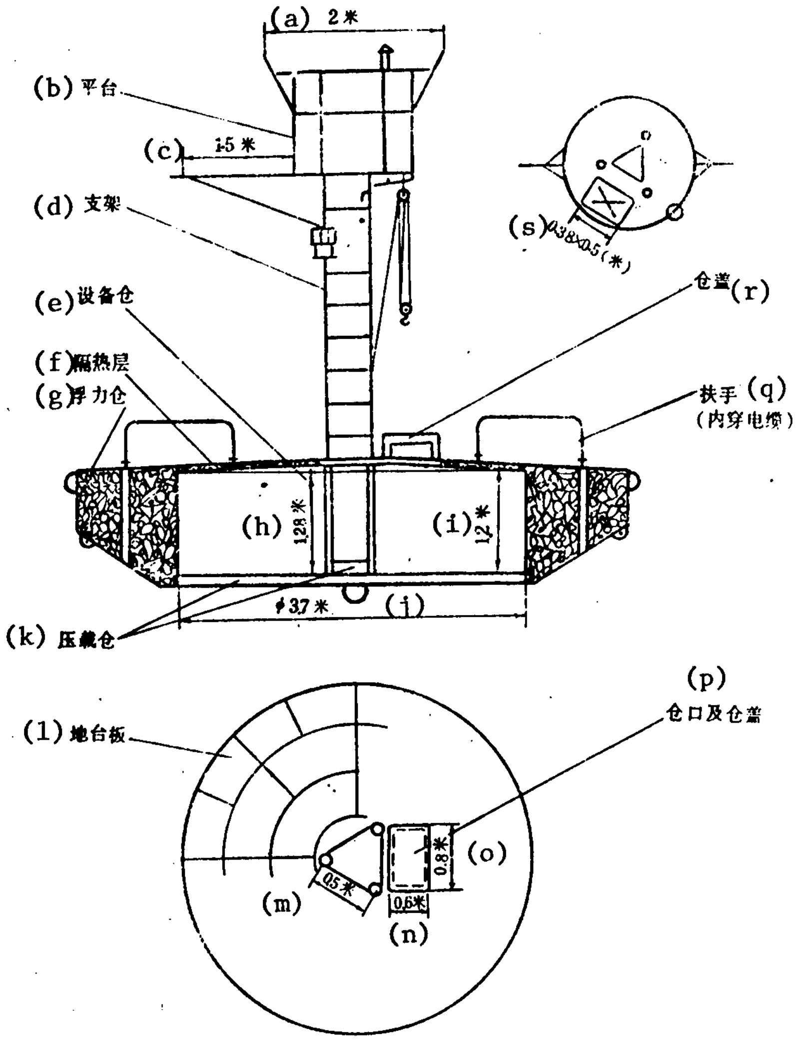


Figure 1. "South China Sea Buoy No 1" Telemetering Buoy

Figure 2. Structure of "South China Sea Buoy No 1"



Key:

a. 2 meters
b. Platform
c. 1.5 meters
d. Support
e. Equipment chamber
f. Insulation layer
g. Flotation chamber
h. 1.28 meters
i. 1.2 meters
j. ϕ3.7 meters
k. Pressure load chamber
l. Platform plate
m. 0.5 meters
n. 0.6 meters
o. 0.8 meters
p. Hatch and cover
q. Handrail (power cable inside)
r. Hatch cover
s. 0.38x0.5 meters

Figure 3. Positioning of Transducers

Key:

1. Current velocity and direction

2. Leakage measuring point

3. Radar reflector

4. Bearing

5. Wind direction

6. Air temperature

7. Mooring beacon

8. Wind velocity

9. Waves

10. Open-door measurement point

11. Water temperature, salinity

12. Anchor drag

13. Antenna

14. Lightning rod

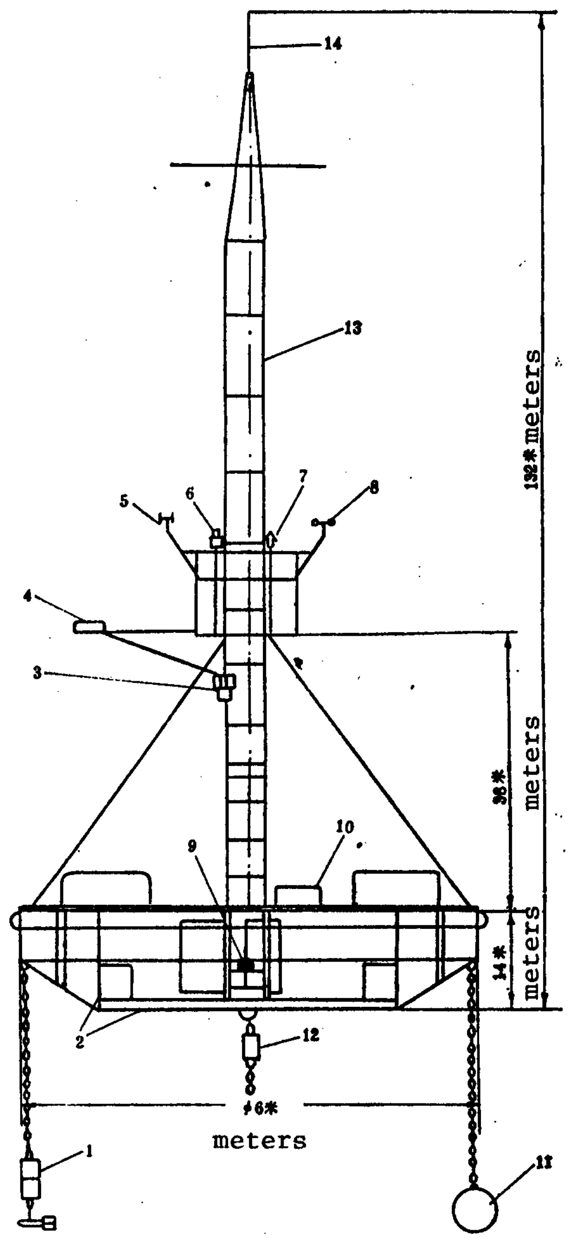
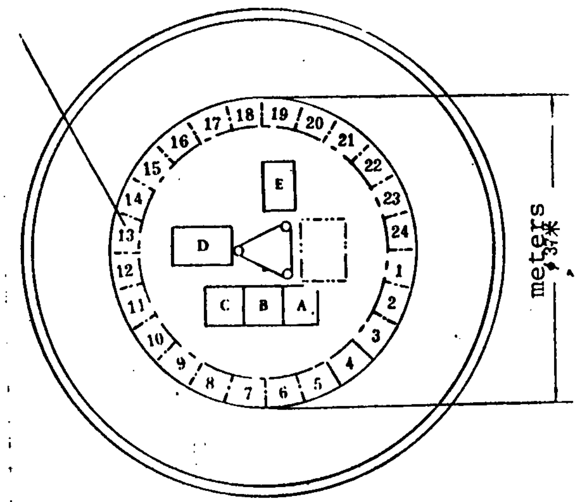


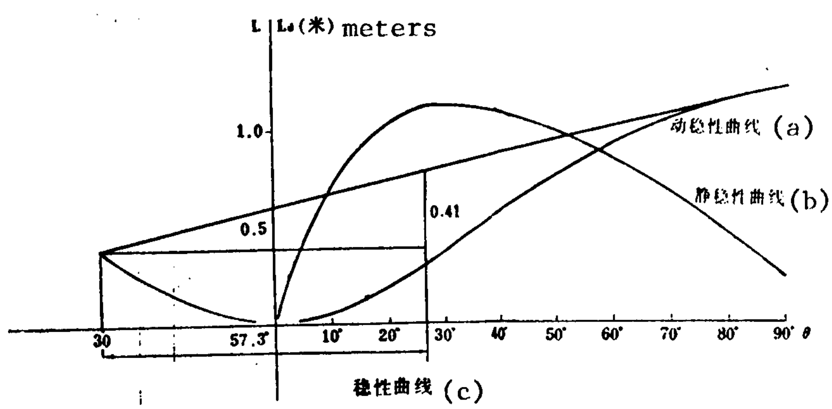
Figure 4. Equipment Installation Inside Cabin



Key:

A. Transmitter 1
B. Receiver
C. Transmitter 2
D. Control and conversion
E. Transducers and warning
F. Power supply and distribution box

Figure 5. Simulated Stability Curve



Key: a. Dynamic stability curve b. Static stability curve c. Stability curve

Displacement 15.5 tons; buoy draught 0.72 m; maximum static stability arm of force corresponding inclination of 30°; static stability vanishing angle >90°; M_f=0.0001PAZ; L_f=m_f/D=0.15(m); L_g=0.41m (θ is minimum qingfu [0282 1788] arm of force when at 30°).

On-site observation buoy situations:

16 October 1979: Noon wind direction was toward the northeast, with a wind force of 3, waves of scale 2, and a buoy pitch angle of 5°.

9 December 1979: Morning from analysis of photographs, waves of scale 3, and a buoy pitch angle of 9°.

28 December 1979: Wind force of 5-6 and buoy pitch angle of 11° (at this time a towboat of over 180 tons passed close by and the towboat's pitch angle was 35°).

13 January 1980: Wind towards the northeast, wind force of 4, waves of scale 3, and a buoy pitch angle of 8-9°; wave height (an average value of 10 measurements) was 017 meters, and buoy rise and fall (average value of 10 measurements) were 0.7 meters.

22 July 1980: Typhoon No 8,007 passed to the south of Xuwen in the northern part of Wenchangxian at 18:00-20:00, the typhoon direction was from the west-northwest, the wind velocity in the center of the typhoon was 40 m/sec, and the typhoon eye diameter was 80 km. At the time the meteorological station measured the maximum wind velocity at Haikou at 41.2 m/sec, at Wenchangxian City it was greater than 40 m/sec, and in Qinglang Harbor (the National Oceanographic Hydrometeorology Station) it was 36 m/sec. The "South China Sea Buoy No 1" experienced this force-12 typhoon without losing its moorings, and the buoy itself including antenna, above and below the water transmitters and auxiliary equipment, was unaffected.

15 September 1980: Typhoon No 8,014 came ashore at Qinglan Harbor in Wenchangxian at 02:00. The maximum wind velocity at Qinglan Harbor was 35 m/sec, and at Wenchangxian City it was 37 m/sec. The typhoon wind direction shifted from southeasterly to north-northwesterly, and after 2 hours shifted to southerly. As it happened, the center of this typhoon moved through the sea area where the "South China Sea Buoy No 1" was moored. On 24 September we carried out on-site observation. The buoy, mooring system and beacon, and above-water instruments were unharmed, and only the lower part of the antenna was bent. This may have been due to someone having slackened some of the guy wires on the antenna.

III. Transmitter System

Wind direction: Twin-vane weather vane using a five-place cyclical code disk.

Average wind velocity: Three-vaned cup anemometer, each revolution of the anemometer produces five pulses and after shaping, and this pulse signal is sent through a 2-minute gate control circuit to the counter memory as a sample.

Instantaneous wind velocity: Measured six times per minute, the maximum value of wind velocity pulses obtained in 10 seconds of recording is selected.

Buoy position: Huazu type compass mounted on an aluminum support.

Salinity: Induction type, temperature compensating, suspended 3 meters underwater.

Water temperature: Platinum resistance wire, suspended 3 meters underwater.

Air temperature: Thermal sensitive resistor with a radiation cover.

Average wave height (On-site working conditions were poor because the zero frequency of the pressure-controlled oscillator was influenced by changes in temperature and the drift was considerable and directly influenced precision.): A gravity accelerator placed at the exact center of the buoy chamber controlled a pressure-controlled oscillator by the voltage accumulated on the memory capacitor in 10 minutes. The frequency output corresponds to the average wave height.

Average wave period: This uses the same gravity accelerator, and each time the output voltage of a balanced detector passes zero it outputs a pulse and the pulses produced in a 10-minute period are similarly stored in another memory capacitor which controls the frequency output by another pressure-controlled oscillator, which is directly proportional to the average frequency of waves and inversely proportional to the average period of waves.

Velocity of flow: Sawoniusi rotor--when the water flow moves the rotor, each turn causes the oscillator to stop vibrating once, and the counter records the number of stop pulses in 2 minutes, which is equivalent to the velocity of flow. It is suspended at a depth of 3 meters.

Flow direction: In the underwater resistor coil, the resistor coil's point of contact with the compass is fixed and when the water flow direction changes it corresponds to a change in position, and changes in the resistor value cause a change in the oscillation frequency.

Anchor chain drag: Resistor strain type. After the DC signal produced by changes in resistance caused by drag is amplified it goes through frequency conversion and the frequency obtained corresponds to the anchor chain drag. The sensor is connected in series where the anchor chain is connected to the buoy.

IV. Program Control, Data Conversion, and Signal Channels

1. Program Control

System automation is realized by using fixed-time program control, calibration condition control, and remote control commands. The program includes the main program and subprograms, and each measurement is transmitted twice at 6,252 MHz and 8,329 MHz alternately at fixed-time intervals (30 seconds) for a total of four times.

Main Program

1) Program 1: Operates once every 3 hours, i.e., eight times a day.

2) Program 2: Operates once every hour, i.e., 24 times a day.

Under normal circumstances the buoy operates on Program 1. When the wind force exceeds 8, the buoy automatically shifts to Program 2. After the wind force drops to 6, its operation automatically reverts from Program 2 to Program 1. Programs can also be shifted at will by remote-control commands from the shore station.

Subprograms

45 min: (15 minutes before the hour) the general power supply on the buoy begins to turn on;

46 min: Receiver turns on, wave transducer set to zero;

49 min: Wave transducer begins operation;

52 min: Receiver turns off;

55 min: Wind velocity, wind direction, flow velocity, and flow direction transducers turn on;

57 min: Encoder set at zero, and each transducer is turned on;

59 min: Antenna shifts to $transmission_1$, and transducer samples are sent to encoder for encoding;

0 min .0 sec: (on the hour): First signal begins to be transmitted;

0 min .5 sec: Begins to transmit synchronous code and remote-measurement information;

0 min .19sec: First transmission complete, and $transmission_1$ turns off power supply;

0 min .25 sec: Antenna turns to $transmission_2$;

0 min .30 sec: Second transmission begins to be sent, operation program the same as the first;

1 min .0 sec: Third transmission begins to be sent;

1 min .30 sec: Fourth transmission begins to be sent;

1 min .55 sec: Operation complete;

2 min .0 sec: Power supply turns off.

Each operation begins at 15 minutes before the hour, i.e., at the above-mentioned 45 minutes and concludes 2 minutes after the hour; remote measurement transmission takes 2 minutes. Remote-control command transmission takes place in the time interval between 46 minutes and 58 minutes.

2. Synchronization of Bit Code

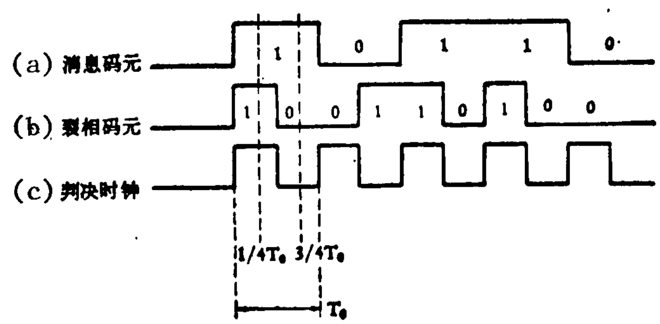
In digital data transmission systems, synchronization of code bits is the key to reliable reception. The data sent from the buoy is made up of a string of successive elements, and the pulse sequence of these elements has the same continuous time; thus, when they are received, the start and stop times of the elements received must be known, otherwise it is impossible to sample and discriminate among them. Thus, an elementary fixed-time pulse sequence is produced at the receiving end and the phase and frequency of repetition of this sequence of pulses are absolutely identical with the elements received. This system uses a fully digital phase-locked loop to extract the bit synchronous signal directly from the flow of data information received. The electrical principles are outlined below (Figure 6).

To prevent errors in synchronization and contradictions of synchronous set-up time on loop demands, we designed two loops: a coarse tuning loop and a fine tuning loop. In the coarse tuning loop we selected a frequency coefficient m_1 slightly smaller; in the fine tuning loop we selected a frequency coefficient m_2 slightly larger to reduce synchronous errors.

Figure 6. Block Diagram of Electrical Principles

Key:

a. Information element
b. Liexiang element
c. Judgment time clock



This system's synchronous set-up time:

Loop synchronous set-up time t_5=530 ms (m_1=40).

Loop synchronous error T=0.07 ms ($m_2$400).

Actual application proves that this loop adjustment is simple and convenient and loop performance is stable and reliable.

3. Group Synchronization

To recover correctly the digital information transmitted, it is first of all necessary to recognize the starting position of the information elements of

each group (each parameter). The group synchronous code groups used to recognize the group information is one method frequently used in digital communication. We used a 16-bit optimum-group synchronous code whose code group formed 1110101110010000. The group synchronous code was detected conforming to an AND gate. This detection method is effective against false synchronization.

4. Information Decoding

This system uses liexiang and parity-checking dual encoding. Liexiang code converts the element "1" in the original information into "1" and "0" and converts "0" into "0" and "1," then makes the first element the information code and the second element the monitor code. So when decoding, just sampling and judging the first sub-element is sufficient. Thus it is suited to determining the information code and monitor code when selecting $1/4T_0$ and $3/4T_0$ in an element.

The forward correcting method is also used in this system for error control within a certain range.

5. Communication System

As much domestic advanced technology as possible was used in the communications system but since at present we still do not have satellite relay conditions, in which single-band shortwave technology was used. To improve reliability, two frequencies and two independent, fully-transistorized transmitters with output power of 50 watts were used on the buoy. The shore station remote-control transmitter output power is 200 watts.

The main technological norms of the communication system are:

Operating frequencies: 6,252 MHz and 8,329 MHz.

Transmission bandwidth: $\leq$1,200 Hz.

Frequency stability (receiving and transmitting): 1×10^{-6}/day.

Operating mode: Frequency shift keying, frequency drift is $\pm$250 Hz.

Output secondary harmonic wave suppression is better than -40 decibels.

Transmission rate is 75 bps.

Receiver sensitivity: 2 mV (S/N=10 decibels).

Receiver bandwidth: 1,200 Hz.

Image resistance ratio: $\geq$60 decibels.

Intermediate frequency resistance ratio: $\geq$60 decibels.

Frequency shift output resistance: $\leq$10 kΩ.

Frequency shift output voltage: High level +8-+10 V, low level 0-1 V.

The communication system is made with existing products. In application we understood that the excessive widths of the transmitter and receiver band were now conducive to resisting interference at low data transmission. The original equipment used the frequency synthesis method in which the defect of the frequent frequency lock-loss occurs. Single-frequency operation had been used, and if a crystal principal-oscillation circuit were used it could greatly simplify the whole system and also help improve precision and reliability. Digital phase-lock, error control, and encoding modulation were used in the system and pulse code modulation, frequency shift keying, time division, and frequency division duplicate diverse reception were adopted for transmission, with a high degree of success and improvement in accuracy.

In order to select suitable operating frequency and necessary power for transmission and to test the performance of the antennas on the buoy and on shore, we carried out two communications tests at sea making the buoy maintain an operating state while transmitting and letting the shore station receive. In addition, we also designed the currently used tower-mounted antenna[11] along the lines of the disc-cone antenna improving both the electrical performance and the mechanical structure. The test results show that under current conditions, the buoy can operate at any distance within the 500-km design range of the system, even as far as the Xisha Islands, which are about 1,000 km away. See Figure 7 for the overall logic diagram.

V. Shore Station

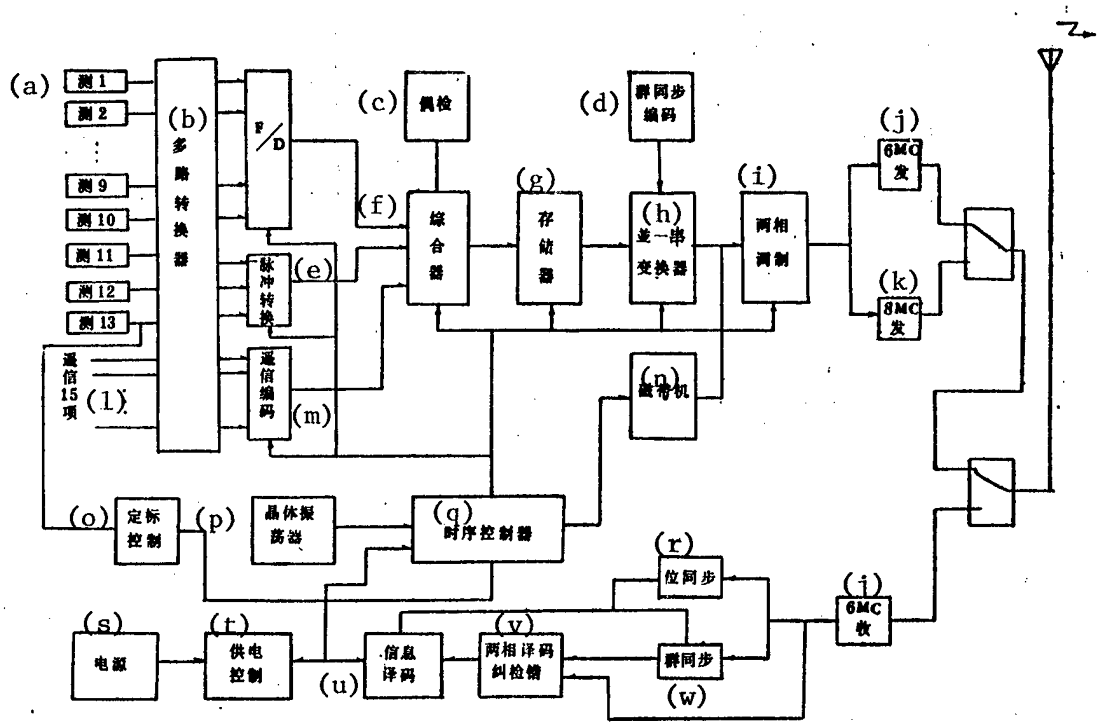
The shore station is on the 6th floor of the Chinese Academy of Science's South China Sea Institute of the Oceanology Laboratory Building, the receiving antenna is a cage type half-wave antenna, two receivers are used alternately for reception, and the digital information received is a string of continuous pulse sequences. To restore and identify the information content, we used a 16-bit group synchronous code for the beginning and end marker of the group information (each parameter) requiring only that the group synchronous code be identified. With this as a marker, conversion and processing by group are carried out, then sent to the register for storage for cyclical fetching and display and at the same time sent to the printer and puncher for printing and punched-paper recording. After initial processing, it is sent to a DJS-130 computer for digital code processing. See Figure 8 for the overall system logic diagram.

VI. Power Supply System

"South China Sea Buoy No 1" currently uses zinc-silver storage batteries with an overall capacity of 130 kwh, which will operate for at least half a year after charging. Each power supply has overload and short-circuit protection and when a short circuit occurs due to an external load, the circuit automatically cuts off output and waits until the next time power is needed. If the external circuit is restored to normal, it can continue to supply power.

The conventional power supply part of the shore station's entire power supply system uses nickel-cadmium batteries, and when the alternating current part of the power supply, which is on municipal power, stops it automatically and switches to the nickel-cadmium batteries, which through a controllable silicon

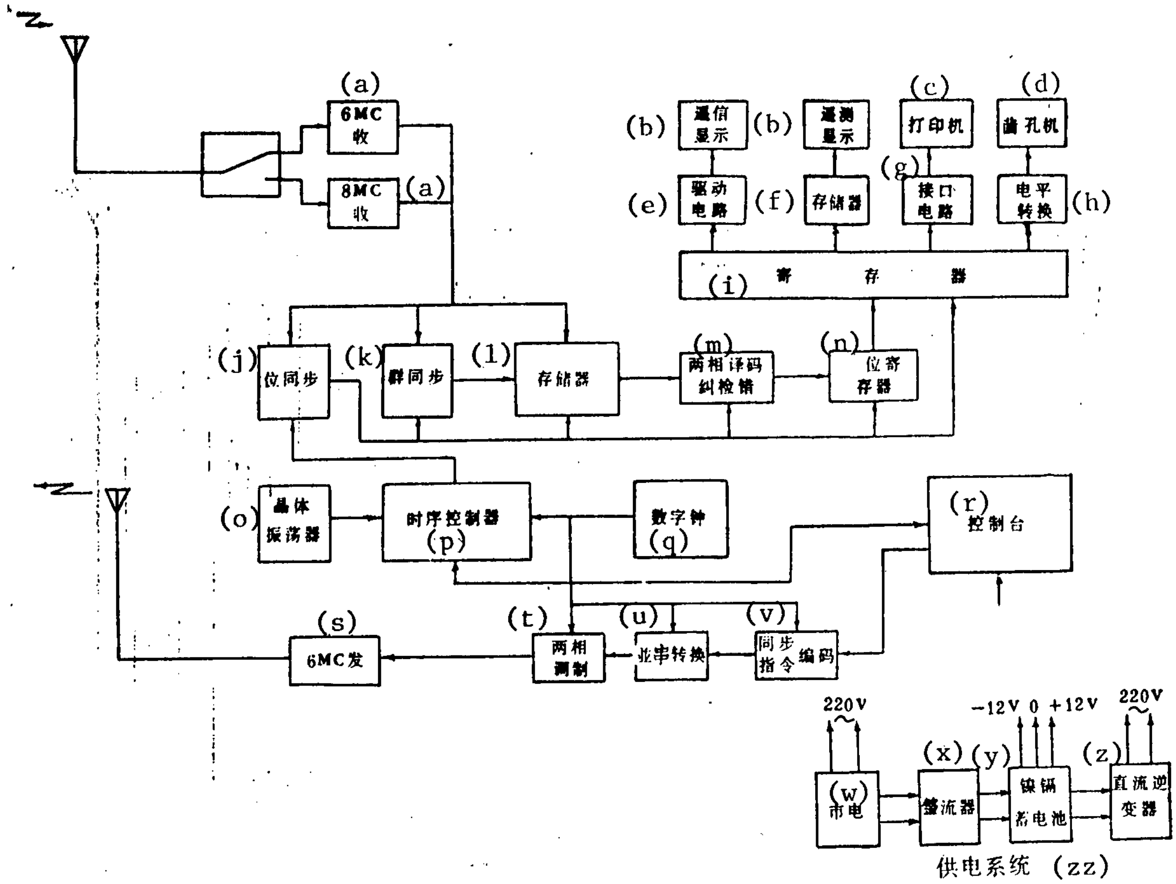
Figure 7. Block Diagram of Overall Buoy Logic



Key:

a. Measurement 1, 2,...etc.
b. Multichannel transmitter
c. Parity check
d. Group synchronous encoding
e. Pulse conversion
f. Synthesizer
g. Memory
h. Parallel-serial controller
i. Two-phase modulation
j. 6MC transmission
k. 8MC transmission
l. Fifteen items of remote information
m. Remote information encoding
n. Magnetic-tape machine
o. Calibration control
p. Crystal oscillator
q. Time sequence controller
r. Bit synchronization
s. Power supply
t. Power supply control
u. Information decoding
v. Two-phase decoding correcting
w. Group synchronization

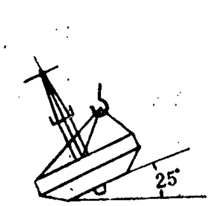
Figure 8. Diagram of Shore Station Logic



Key:

a. Reception
b. Remote communication display
c. Printer
d. Punch
e. Driver circuit
f. Register
g. Interface circuit
h. Level converter
i. Register
j. Bit synchronization
k. Group synchronization
l. Register
m. Two phase decoding correction
n. Bit register
o. Crystal oscillator
p. Time sequence controller
q. Digital clock
r. Control console
s. 6MC transmission
t. Two-phase modulator
u. Parallel-serial conversion
v. Synchronous command encoding
w. Municipal power
x. Rectifier
y. Zinc-cadmium batters
z. DC inverse transformer
zz. Power supply system

Figure 9. Diagram of Buoy Angled at Deployment



inverse transformer provides a power supply of 220 V and 50 Hz, ensuring that the shore station can operate normally for any length of time. The entire shore station is automated but when necessary can be converted to manual operation.

VII. Deployment and Recovery

Since the buoy is tall and the sea-surface waves are large, deployment by a shipboard crane is very difficult. Thus, we used a crane angled at 25° angle crane and placing it on site. During recovery, the mooring system is first disconnected, a beacon 1.8 meters in diameter is attached to it, and the buoy is towed into the harbor by a towboat. Recovery and deployment on 31 December 1979, 21 April 1980, and 2 June 1980 all went rather smoothly.

VIII. Operational Situation of Buoy at Sea

1. System Operation

a. Moored at sea southeast of Qinglan Harbor in 22.5 meters of water

From 26 to 30 October 1979, it operated for 99 hours using the 1-hour operating program. At the time the seas were 5-6, and subsequently the buoy was unable to continue transmitting signals due to poor contacts of plugs related to the instruments.

The buoy automatically returned to operation starting at 16:00 hours on 19 November 1979 and operated until 18:00 hours on 31 December, when the power was cut off manually.

The 3-hour program operated continuously from 15:00 hours on 15 February 1980 until 23:00 hours on 8 June.

b. Moored in the Qinglang Harbor in 9.5 meters of water

The buoy operated using the 3-hour operating program continuously from 12:00 hours on 13 January 1980 until the power was cut off manually at 9:00 hours on 21 April. The system operation was excellent.

2. Preliminary Statistics on Success Rate of Buoy System Data Reception

For the success rate of data reception, see Table 4.

3. Preliminary Comparative Testing of Signal Channel Errors

From 23:00 hours on 30 May to 01:00 hours 31 May, 1980, synchronous comparative tests on the buoy's signal channel errors were simultaneously carried out at Qinglang Harbor, Hainan, and at the Guangzhou Shore Station. The buoy was operating using the 1-hour program. The encoded values of the measurement results of the transducers on the buoy were extracted before the signals were sent to the transmitter and at the same time the shore station read the encoded values which were received and printed out. Using a radio-telephone, contact and comparison were made with the buoy. For the results of the com-

Table 4. Statistics on Success Rate of "South China Seas No 1" Buoy Data Reception

Time	Number Which Should Have Been Received	Number Actually Received	Reception Success Rate (percent)
26-30 October 1979 (1-hour program)	99	97	98
20 November-12 December 1979) (1-hour program)	600	529	88
13 January-28 February 1980 (3-hour program)	376	303	80
1-8 June 1980 (3-hour program)	64	48	75

parison, see Table 5. Due to objective limitations, it was impossible to carry out lengthier comparative tests of signal channel errors. Except for the wind direction at 23:00 hours on 30 May in the above three hourly comparative tests, the results are all uniform.

4. Transducer Measurement Situation

a. Synchronous comparative tests were carried out on the relevant items on the buoy at sea (the ship was anchored in the vicinity of the buoy) at 09:00 and 10:00 hours on 28 October 1979. The results are below (Table 6).

Table 6. Results of Synchronous Comparitive Tests

Time	Items											
1979	Wind Speed (m/sec)		Wind Direc-tion		Air Tempera-ture (°C)		Water Tempera-ture (°C)		Wave Height (meters)		Wave Period	
28 Octo-ber	Buoy	Comp. Inst.	Buoy	Comp. Inst.	Buoy	Comp. Inst.	Buoy	Comp. Inst.	Buoy	Comp. Inst.	Buoy	Comp. Inst.
0900	3.0	3.0	N	NNE	25.9	27.2	26.03	26.05	1.3	0.9	-	7.3
1000	5.0	4.4	N	NEE	26.0	27.0	26.04	26.06	2.2	1.0	9.6	8.0

Table 5. Results of Comparison of Signal Channel Errors

Time	23:00 30 May 80		00:00 31 May 80		01:00 31 May 80	
Send/rec sta / Meas. value / Item	Buoy	Shore	Buoy	Shore	Buoy	Shore
Wind direction*	(016)	(036)	012	012	124	124
Bearing	11,207	11,207	11,219	11,219	11,228	11,228
Air pressure**	0	0	0	0	0	0
Salinity	4,935	4,935	5,013	5,013	5,081	5,081
Water temperature	4,193	4,193	4,192	4,192	4,176	4,176
Air temperature	12,235	12,235	12,237	12,237	12,291	12,291
Wave height	3,524	3,524	3,540	3,540	12,291	12,291
Wave period	3,371	3,371	3,845	3,845	3,354	3,354
Mooring chain pull	2,605	2,605	2,597	2,597	2,596	2,596
Current direction	20,461	20,461	14,276	14,276	16,697	16,697
Current velocity	Serviced		Serviced		Serviced	
Instantaneous Wind velocity	Serviced		158	158	153	153
Average wind velocity	Serviced		645	645	245	245

* At 23:00 hours the wind direction at the buoy was (016) and the shore station printed out (036), but it was clear from the ray oscilloscope that there had been interference.

** The air pressure transducer had not yet been installed.

b. Single-machine comparative tests of the Buoy on 9 and 10 January 1980

Single-machine comparative tests on the buoy's transducers were carried out on site using a comparator before the data measured by the buoy's transducers had been sent out over the signal channel. Due to limitations of time and conditions at the time, tests on water temperature, salinity, buoy bearing, and waves were not carried out. The results of the comparative tests are below (Table 7).

Table 7. Single-machine Comparative Tests of Average Wind Velocity and Instantaneous Wind Velocity

Time	Item		
1980	Average Wind Velocity (m/sec)		
9 Jan hrs:min	Buoy Transducer	Comparator	Difference
09:30	5.6	6.1	+0.5
09:35	6.5	6.1	-0.5
09:40	6.1	5.7	-0.4
10 Jan hrs:min			
14:42	4.3	4.3	0.0
14:45	4.2	3.9	-0.3
14:48	5.7	5.7	0.0
14:50	4.7	4.5	-0.2
15:25	5.5	5.1	-0.4
15:29	5.6	4.0	-1.6
15:33	7.3	7.0	-0.3

5. Comparison of data received and printed out by the shore station through the entire system and data actually measured by the comparator at the same time on site. See Tables 10-12 for the results.

6. Comparison of Buoy Records with Meteorological Station Measurements

For a comparison of data recorded by the buoy (moored in Qinglan Harbor) and actual measurement data of the Qinglan Harbor Meteorological Station of the Marine Bureau at 14:00 hours on each day between 15 January and 10 February 1980, see Figures 10-13.

Table 8. Single-machine Comparison of Air Temperature

Time	Item		
1 October 1980 hrs:min	Transducer in Louvered Box, Uncovered (°C)	Mercury Temperature Calculated in Louvered Box (°C)	Assmann Outside Louvered Box (°C)
16:30	22.4	22.6	22.8
16:40	22.2	22.6	22.8
1 October 1980 hrs:min	Transducer Outside Louvered Box, Covered (°C)	Mercury Temperature Calculated Inside Louvered Box (°C)	Assman Outside Louvered Box (°C)
16:45	22.7	22.6	22.8
16:50	23.1	22.6	22.8

Table 9. Single-machine Comparison of Flow Velocity and Direction

(a) 时间	(b) 项	目	(a) 时间	(b) 项	目
(c) 1980 年	(d) 流速(米/秒)		1980 年	(e) 流向(度)	
(f) 1月9日 时:分	(g) 浮标传感器	(h) 印刷海流计	(f) 1月9日 时:分	(g) 浮标传感器	(h) 印刷海流计
09:07	0.12	0.11	10:42	312°	318°
09:12	0.085	0.08	10:47	312°	305°
10:47	0.13	0.11	10:52	313°	319°
12:57	0.062	0.08	16:22	140°	142°
13:07	0.143	0.14	16:32	140°	133°
13:12	0.093	0.06	16:42	140°	133°
13:22	0.082	0.1	16:52	138°	139°
13:32	0.1	0.1	17:02	135°	134°
13:52	0.075	0.06	17:12	145°	141°
14:42	0.115	0.1	17:22	154°	138°
16:22	0.057	0.06			
16:32	0.111	0.06			
16:42	0.135	0.09			
16:52	0.09	0.06			
17:12	0.148	0.16			
17:22	0.168	0.16			
17:27	0.15	0.14			
17:32	0.16	0.11			
17:42	0.143	0.16			
17:47	0.105	0.1			
1月10日(i) 时:分					
08:57	0.09	0.08			
09:02	0.07	0.09			
09:12	0.047	0.08			
12:02	0.16	0.16			
12:12	0.145	0.15			
12:22	0.155	0.14			
12:27	0.12	0.13			
12:37	0.13	0.15			
12:42	0.155	0.18			
12:47	0.165	0.2			
12:52	0.12	0.15			

Key:

a. Time
b. Item
c. 1980
d. Flow velocity (m/sec)
e. Flow direction (deg.)
f. 9 January, hrs:min
g. Buoy transducer
h. Printing current meter
i. 10 January, hrs:min

Table 10. Comparison of Flow Velocity and Flow Direction Results

Time January 1980	Flow Velocity (m/sec)		Flow Direction (deg)	
	Shore Station	On-site Comparator	Shore Station	On-site Comparator
13th 13:00	0.15	0.20	355°	320°
16:00	0.36	0.34	329°	324°
17:00	0.36	0.29	332°	327°
14th 20:00	0.20	0.19	350°	318°

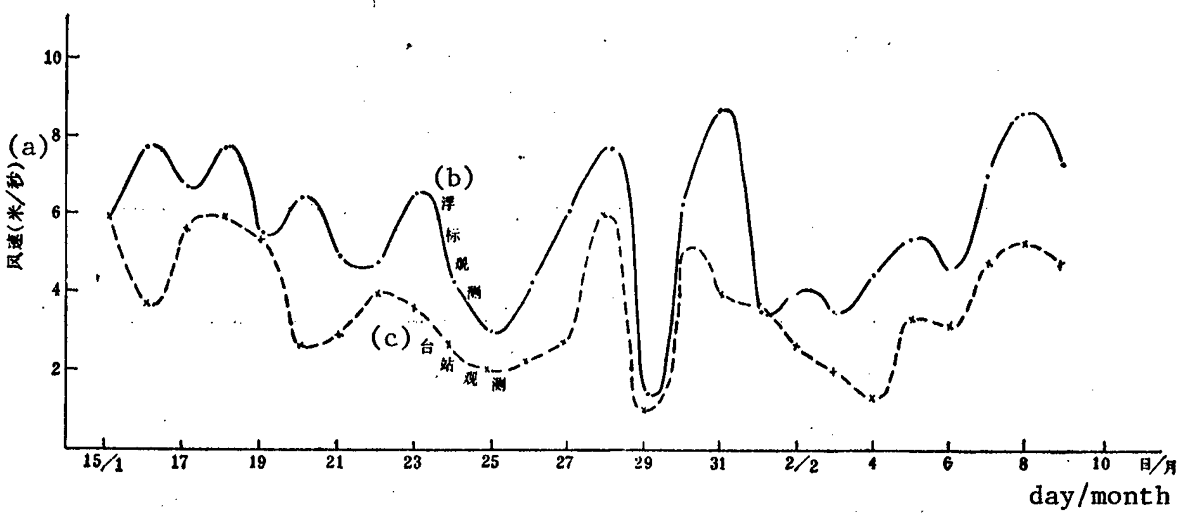
Table 11. Comparison of Wind Speed and Air Temperature Results

Time January 1980	Wind Speed (m/sec)		Air Temperature (°C)	
	Shore Station	On-site Comparator	Shore Station	On-site Comparator
13th 16:00	5.6	5.8	21.2	22.3
18:00	4.7	4.0	20.4	21.4
19:00	5.1	4.5	19.9	21.0
20:00	5.1	5.0	19.3	20.1
21:00	4.9	4.6	19.1	20.2
22:00	4.6	4.3	19.0	19.8
14th 06:00	5.1	5.1	18.5	19.3
08:00	5.9	5.5	18.2	19.0
10:00	5.3	5.3	18.4	18.1
11:00	6.2	6.7	18.2	18.9
12:00	4.9	4.6	17.6	18.4
14:00	5.6	5.1	16.6	17.3

Table 12. Comparison of Water Temperature and Salinity Results

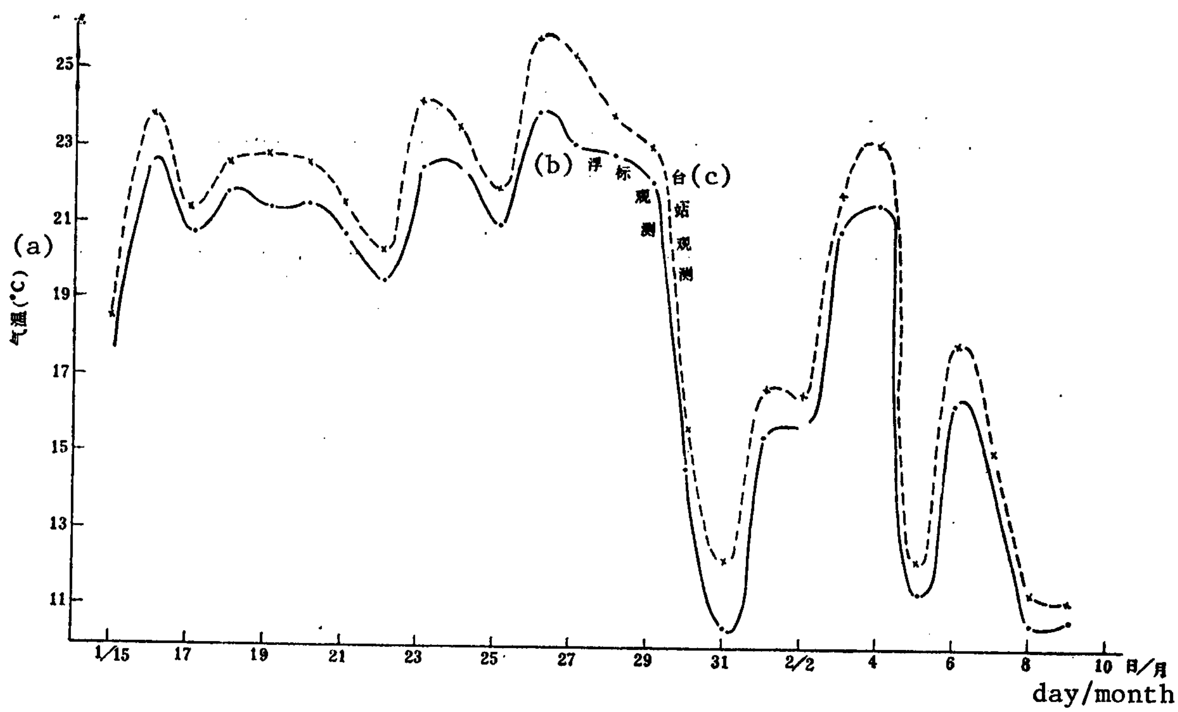
Time January 1980	Water Temperature (°C)		Salinity (0/00)	
	Shore Station	On-site Comparator	Shore Station	On-site Comparator
13th 15:00	21.8	22.7	29.9	31.9
16:00	21.9	22.0	32.7	32.6
17:00	22.2	22.0	33.2	33.1
18:00	22.1	22.1	33.4	33.3
19:00	22.1	22.1	33.4	33.3
20:00	22.0	21.0	33.2	33.3
22:00	21.9	21.8	33.0	32.5
23:00	21.6	21.7	32.2	32.0
14th 12:00	21.5	21.4	29.8	31.5
14:00	21.4	21.4	29.8	31.6
15th 11:00	20.7	20.7	32.4	32.1

Figure 10. Comparative Curves of Wind Velocity



Key: a. Wind velocity (m/sec) b. Buoy observation c. Platform observation

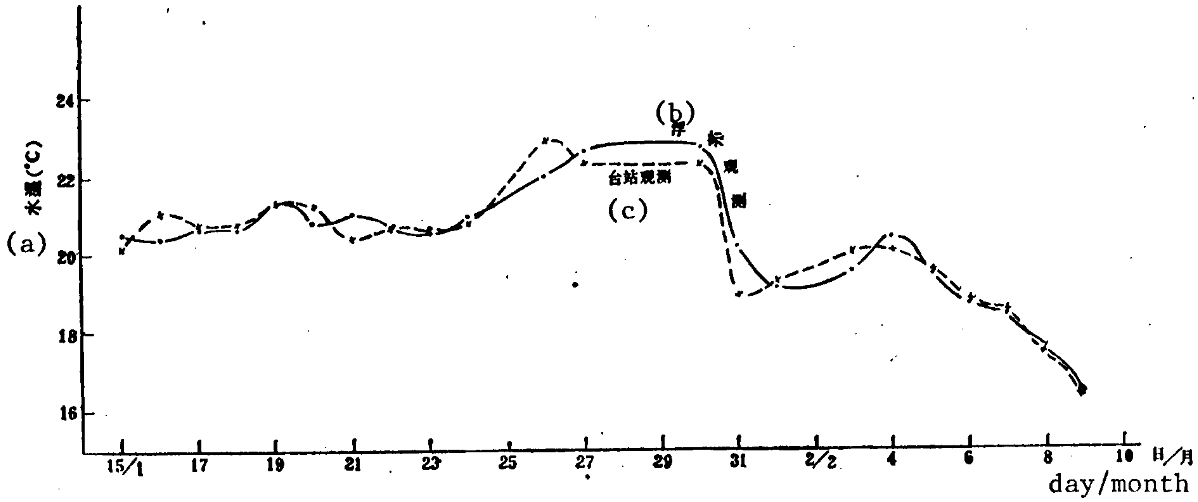
Figure 11. Comparative Curves of Air Temperature



Key:

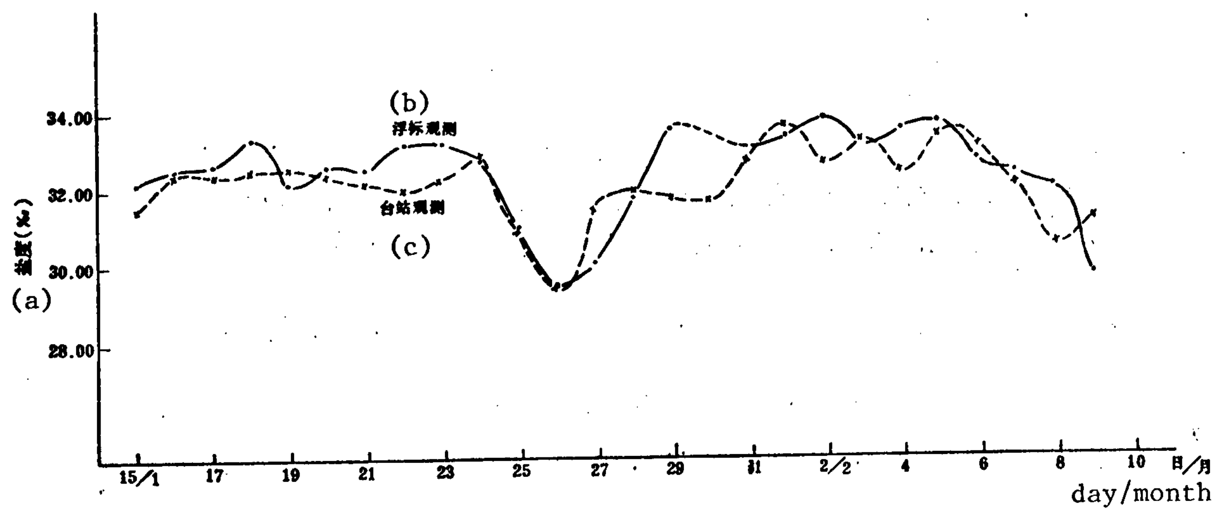
a. Air temperature (°C)
b. Buoy observation
c. Platform observation

Figure 12. Comparative Curves of Water Temperature



Key: a. Water temperature (°C) b. Buoy observation
c. Platform observation

Figure 13. Comparative Curves of Salinity



Key:

a. Salinity (0/00) b. Buoy observation c. Platform observation

Concluding Remarks

Compared with the similar installations which were beginning to be used abroad in the seventies (such as Japan's No 3 buoy and the U.S. EB-02 buoy), the primary function and technological line of the "South China Sea Buoy No 1" buoy system are very close in transmission method, designed capacity, and measurement.

Before the buoy was deployed, communication channel tests were carried out on 2 days in November 1978 between Guangzhou and the vicinity of Yongxing Island on Xisha Island (a distance of about 1,000 km). Except for a problem with reception related to the ion layer at 4:00-6:00 am, the results were excellent.

Tests at sea for the past year indicate that the operating distance of the "South China Sea Buoy No 1" automated-buoy system can reach beyond 500 km. Since there are still some problems with the quality of some transducers, the useful life is currently rather short and replacement and maintenance are difficult. Thus, we must wait for further research and improvement in the transducers for measurement precision to be improved.

FOOTNOTES

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8226/8918
CSO: 4008/1065

APPLIED SCIENCES

COMPUTERIZED FLIGHT SIMULATOR CREATES LIFELIKE CONDITIONS, CUTS COSTS

Shenyang LIAONING RIBAO in Chinese 29 Oct 86 p 3

[Photograph and caption]

An Air Force flight training school has developed a spherical, full-view flight simulator. The simulator uses a microcomputer-controlled real-time simulation system. By using this simulator to train pilots, actual flight conditions can be realistically duplicated and flight training costs greatly reduced. Shown in the photograph is a pilot undergoing flight training using a ground model (at left).

/9365
CSO: 4008/19

LIFE SCIENCES

EFFECTIVE TREATMENT FOR MALIGNANT LYMPHATIC TUMOR REPORTED

Beijing RENMIN RIBAO in Chinese 7 Oct 86 p 1

[Article: "China Makes Breakthrough in Treating Malignant Lymphatic Tumors; Successfully Developed TC-S Brings Hope To Overcome 'God of Plague'"]

[Text] Xi'an XINHUASHE 6 October--The age-old plague of malignant lymphatic tumor may be on the verge of being conquered by the TC-S injection preparation. This successful development may enable China to make a breakthrough in conquering this disease.

In the past, no medical field either at home or abroad has had an effective way to treat malignant lymphatic tumors and each year many patients have died because of lack of effective treatment. Early in 1985, the No 2 Hospital of Xi'an City, the Hygiene Institute of the Ministry of Ordnance Industry and Shanxi Endemic Diseast Control Office organized a scientific research effort to tackle the problem. They discovered that malignant lymphatic tumor is related to human immune-deficiency and by giving patients injections of TC-S preparation (liquid) the deficiency could be remedied.

Starting this year, they formally put TC-S injection preparation into clinical use. Among 10 injected with malignant lymphatic tumor, the tumor lumps in 6 patients disappeared in 10 days and the symptoms were alleviated. The symptoms of the remaining four patients were partially eased. The malignant tumor in a female teacher's body was about the size of a fist when she was admitted to the hospital, but the lump completely disappeared in 10 days after four injections of TC-S preparation.

A large amount of research work and many clinical tests indicate that TC-s injection liquid has a clear effect in killing or inhibiting cancer cells. The effectiveness of the cure is especially effective on patients with middle and late phases of malignant lymphatic tumor. The medical research staffs have also used this method to treat and observe 60 patients with malignant tumors of the colon, rectum, breast, and lung. They discovered that the degree of patient immunity increased variously. Generally, feeling better, increasing appetite greatly and suffering reduced.

/12232
CSO: 4008/3008

LIFE SCIENCES

NEW CHINESE CONTRACEPTIVE MAY SEE WORLDWIDE USE

Bejing RENMIN RIBAO in Chinese 29 Sep 86 p 3

[Text] A new contraceptive method has been successfully developed by Zhao Shengcai [6392 3932 2088] head of the medical staff of the Shanxi Provincial People's Hospital. The injected plug-block method permitting a restored spermaductus was recently listed as a national priority science and technology project by the related state organs during the Seventh 5-Year Plan period.

This new birth control method is administered by syringe with a plug and block preparation of high-molecule polyurethane compound into spermatic ducts, the preparation (agent) then acts as a plug to block the passages of sperm to attain the goal of contraception. The plug can be successfully removed and the function of spermatic ducts restored as necessary. After several clinical tests, this method has proven to be highly effective, safe, convenient, and economic.

This July [1986], the director of the Guiding Committee, special section of the UN Health Organization wrote to China's related departments and to Zhao Shengcai personally to express the UN Health Organization's decision to popularize this new contraception technique around the world.

/12232
CSO: 4008/3008

LIFE SCIENCES

BRIEFS

LIVER CANCER DIAGNOSIS DEVELOPED--Nanjing, 21 Oct (XINHUA)--Chinese scientists have developed a new diagnostic method in the treatment of liver cancer, resulting in patients getting earlier treatment. Meng Xianyong, a scientist of the Natogn Medical College in east China's Jiangsu Province, started experimenting with the new method with one of his colleagues in 1983. He says, "The improved method of serum dissociation is more accurate in diagnosing liver cancer than the previous popular method of testing alpha fetoprotein, a kind of fetus protein which appears in the blood of liver cancer patients." A total of 354 patients have been tested by the new method and the percentage of positive reactions increased to 90 percent from 29.5 percent. Among them, 80 percent of 100 liver cancer patients, who had been misdiagnosed by the alpha fetoprotein test, showed positive reactions when tested by the new method, Meng said. Every year, 100,000 people die of liver cancer in China and surgery in early-stage cases enables many patients to survive more than 5 years. This method, which passed inspection last August, has been used in hospitals in 10 Chinese cities and has achieved satisfactory results. [Text] [Beijing XINHUA in English 0633 GMT 21 Oct 86] /9604

CSO: 4010/3001

ENVIRONMENTAL QUALITY

SUZHOU WATERWAY TARGET OF MAJOR CLEAN-UP EFFORT

OW241045 Beijing XINHUA in English 0754 GMT 24 Oct 86

[Text] Shanghai, 23 Oct (XINHUA)--The black, stinking waters of the Suzhou River, which flow through Shanghai, China's largest industrial center, will be the target of a major clean-up, a municipal official said here today.

The Suzhou flows into the Huangpu River in Shanghai. At the junction the black and smelly water of the tributary can be seen to ooze into muddy waters of the main river. The Suzhou River has been seriously polluted since the 1920's. Forty-seven percent of the city's industrial waste, from suburban factories, is dumped into the Suzhou.

With the help of a U.S.$100 million loan from the World Bank the clean-up project will be the largest city works project ever undertaken here, the official said.

Work on the project is scheduled to begin next year. When completed in 1992, the dirty, stinking river will meet water quality standards set by the state water discharging department.

Since 1983, the Shanghai municipal government has invited 50 Chinese and Australian experts to study how best to clean up the Suzhou. More than 100 reports have been delivered to the municipal government.

According to the present plan, the official said, industrial waste water and sewage flowing into the Suzhou River will be treated. The purified water will then be diverted to the mouth of the Yangtze River through a pipe 4 meters in diameter.

The project will provide experience for treating waste water in other coastal cities in China, the official noted.

/9604
CSO: 4010/3002

APPLICATION OF COMPUTER IN 542 CASES OF BLOOD-GAS AND ACID-BASE ANALYSES

Beijing ZONGHUA YIXUE ZAZHI [NATIONAL MEDICAL JOURNAL OF CHINA] in Chinese Vol 66 No 5, 15 May 86 pp 271-274, 318

[English abstract of article by Gu Junming [7357 0193 2494], Yan Dexiang [0917 1973 4382], Lei Zhenzhi [7191 2182 0037], Wei Dengyun [7614 3397 0061], et al., of Dalian Medical College; paper received 25 July 1985, 27 February 1986]

[Text] The APPLE-II microcomputer was used in 542 cases of blood-gas and acid-base analyses. Examinations with input of 11 types of acid-base disorders proved that the results of judging acid-base disorders by computer were in close agreement with those by comprehensive judgment. The rate of complete coincidence was 98.8 percent. These results were evidently better than those judged by the doctor's preliminary comprehension or by the three acid-base charts. For judgment of the state of oxygenation, there were eight indices, capable of making judgments of hypoxemia, deficient $C\text{-}O_2$, shifting of oxygen dissociation curve etc. and thus reflecting more comprehensively the oxygenation status of the organism.

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